Hemp Business Journal
a division of New Frontier Data

THE GLOBAL

STATE OF HEMP

2019 INDUSTRY OUTLOOK

Sponsored by:

Hoban Law Group · Shi Farms · Mary's nutritionals

Published by:

New Frontier data

TABLE OF CONTENTS

LETTER FROM THE PUBLISHERS

NEW FRONTIER DATA is proud to announce the release of its latest industry report, *The Global State of Hemp: 2019 Industry Outlook*.

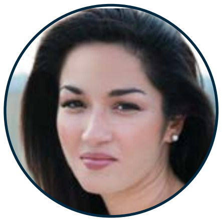
Hemp has been making headlines for its impact on several mature markets – from food and textiles, to building construction and nutraceuticals. Hemp is emerging as a potential commodity ripe to not only influence but possibly revolutionize major economic sectors around the world.

While China and Canada represent two of the world's leading markets, their leadership will be challenged as countries around the world begin to embrace the plant and its applications. The passage of the 2018 Farm Bill which allows American farmers to cultivate hemp in a fully federally legal setting starting with their 2019 harvests will activate the long-dormant U.S. market. And with the U.S. being the world's largest importer of hemp products, its hemp cultivation industry is poised to serve the massive and still-growing domestic market.

As this report details, the global market extends across seven geographic regions: the U.S., Canada, China, the European Union, Australia, both South and Central America, and Africa/Other. The report likewise examines seven hemp industry sectors that are positioned for the greatest growth trajectories as governments activate hemp markets, and consumers embrace hemp-derived CBD and other supplements.

The expansive ways in which hemp can be used for high- and low-tech applications will create major opportunities in markets around the world. As with other reports in New Frontier Data's ever-expanding library, we hope the analysis and insight in *The Global State of Hemp* will guide investors and business operators on what promises to be one of the hottest sectors of tomorrow's economy.

We wish to thank our report sponsors from Hoban Law Group, Shi Farms and Mary's Nutritionals for their interest and cooperation in its production. We hope that you enjoy all the benefits of this report as you shape your strategy and action plan within the cannabis industry!



Giadha Aguirre de Carcer
Founder and CEO
New Frontier Data

Sean Octavius Murphy
Founder
Hemp Business Journal
Director of Hemp Analytics
New Frontier Data

ABOUT OUR SPONSORS

Hoban Law Group is the nation's premier cannabis business law firm, serving clients across the globe with medical and adult use marijuana businesses as well as those operating in the industrial hemp sector.

Since 2015, Mary's Nutritionals has been distilling the wisdom of plants to help people reach the full potential of their bodies, minds and lives, and has set the standard for a proven alternatives for relief. Pulling together a team of physicians, chemists, botanists, and nutritionists, Mary's unrivaled line of hemp-derived CBD infused products includes a transdermal patch, patented transdermal gel pen, tincture, topicals, bath bombs, skincare products and more. More information is available at marysnutritionals.com.

As a vertically integrated CBD ingredient supplier, Shi Farms believes the future of hemp as a revolutionary crop relies not only on innovation of retail products and underlying supply chain scaling, but equally on setting an example for global agriculture regarding sustainable environmental and business practices.

EXECUTIVE SUMMARY

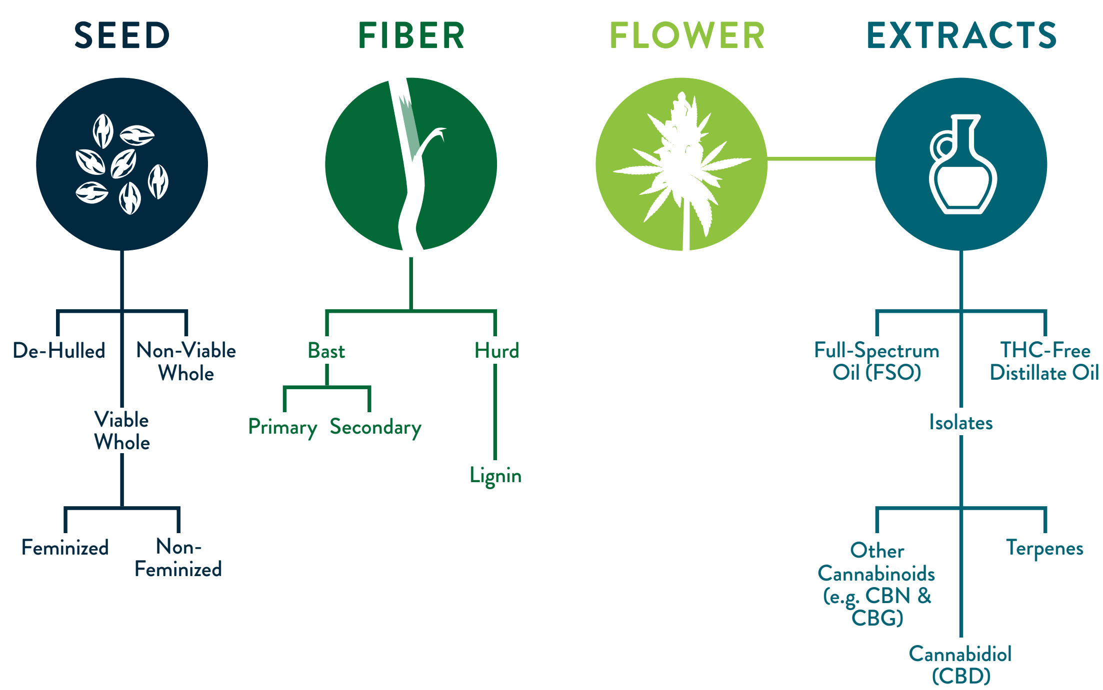
THE GLOBAL HEMP revolution has begun. Hemp markets are developing, expanding, and impacting agriculture and retail markets around the world. The time is now to review, analyze, and seize the opportunities in this dynamic, emerging market.

What is Hemp?

Hemp is a fast-growing, environmentally friendly plant with a low cost to produce. It is one of the most diversely applied and sustainable crops in the world. Hemp has many uses and byproducts that have driven farmers to embrace the crop as a hedge against lower-value crops like soy, cotton, canola, and alfalfa.

As an agricultural commodity, hemp is grown for its seed, fiber, and flower, or as a multicrop (i.e., hemp grown for both seed and fiber). The seed, stalk, and flower are all used commercially. A hemp seed (or grain) is smooth, hard, and about ¼ of an inch long. The stalk is comprised of a short woody interior (called hurds), while the plant's outer part consists of long fibers (called bast fiber). Flowers (and to a small degree other parts of the plant such as the leaves) are used to create hemp extracts, oils and cannabinoid isolates.

Biologically, hemp belongs to a family and genus of plants with wide chemotypic diversity. The genus Cannabis (hemp and marijuana) is part of the Cannabaceae family of plants, which includes a total of 170 species. Interestingly, a primary ingredient of beer, Humulus (hops), is also from the Cannabaceae family, making hops and cannabis genetic cousins.



Cannabis contains three primary subspecies — Sativa, Indica and Ruderalis — and has a record of use dating back thousands of years. Indeed, recent discoveries suggest that hemp may have been among the first plants humans domesticated, over 10,000 years ago. Historical data shows how past cultures of Asia, India, and Europe utilized hemp for industrial and medical benefits. Ancient documents from Egyptian and Greek physicians illustrate hemp's use both for medical and industrial purposes.

The legal definitions and differences between cannabis, marijuana and hemp vary worldwide based on varying levels of the psychoactive cannabinoid, tetrahydrocannabinol (THC). In most countries, hemp is defined as cannabis with less than 0.3% THC on a dry weight basis, while in several countries (including Switzerland), hemp is defined as less than 1.0% THC. As such, the distinction between hemp and marijuana is a legal construct applied to the same genus of plants, cannabis.

In this report, cannabis refers to the plant species Cannabis sativa L and all of its industrial, medicinal, and recreational varieties. The terms hemp and industrial hemp are used interchangeably, and the term marijuana refers to the plant used as a medicinal or recreational drug.

“ Recent discoveries suggest that hemp may have been one of the first plants humans domesticated, over 10,000 years ago. ”

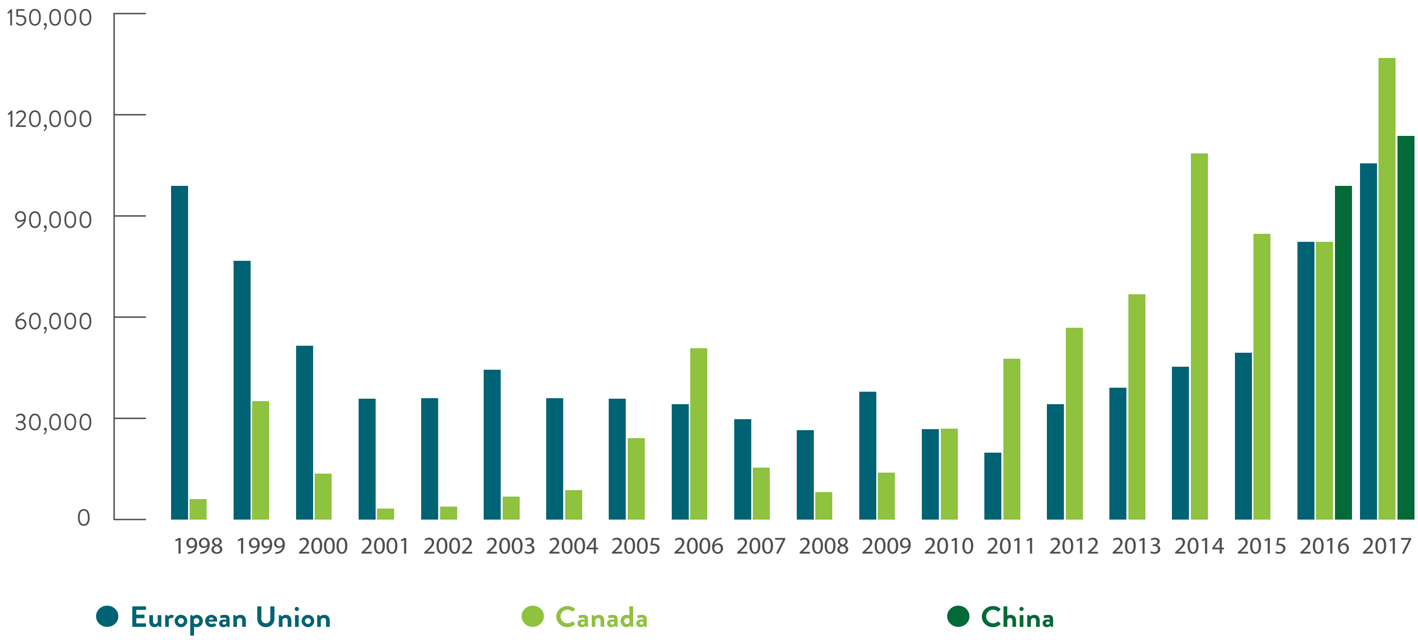
In the early 1990s there were less than 10 countries growing hemp as part of an organized, commercial market. Today, approximately 30 countries commercially grow hemp, with 15 countries conducting research. In all, there are nearly 50 countries now growing hemp, and many more considering whether to permit its cultivation.

Global Markets

Currently, there are three mature hemp producer markets: China, Canada, and the European Union. As of the publication of this report, most regions have not reported their 2018 cultivation numbers (except the United States). According to Health Canada, there were 137,000 acres of hemp planted in Canada in 2017, with Saskatchewan leading all provinces (with nearly 56,000 acres planted), followed by Alberta (with almost 45,000 acres planted), and Manitoba (with 30,000 acres planted). Most of Canada's hemp products are exported for sale in other countries, primarily the United States.

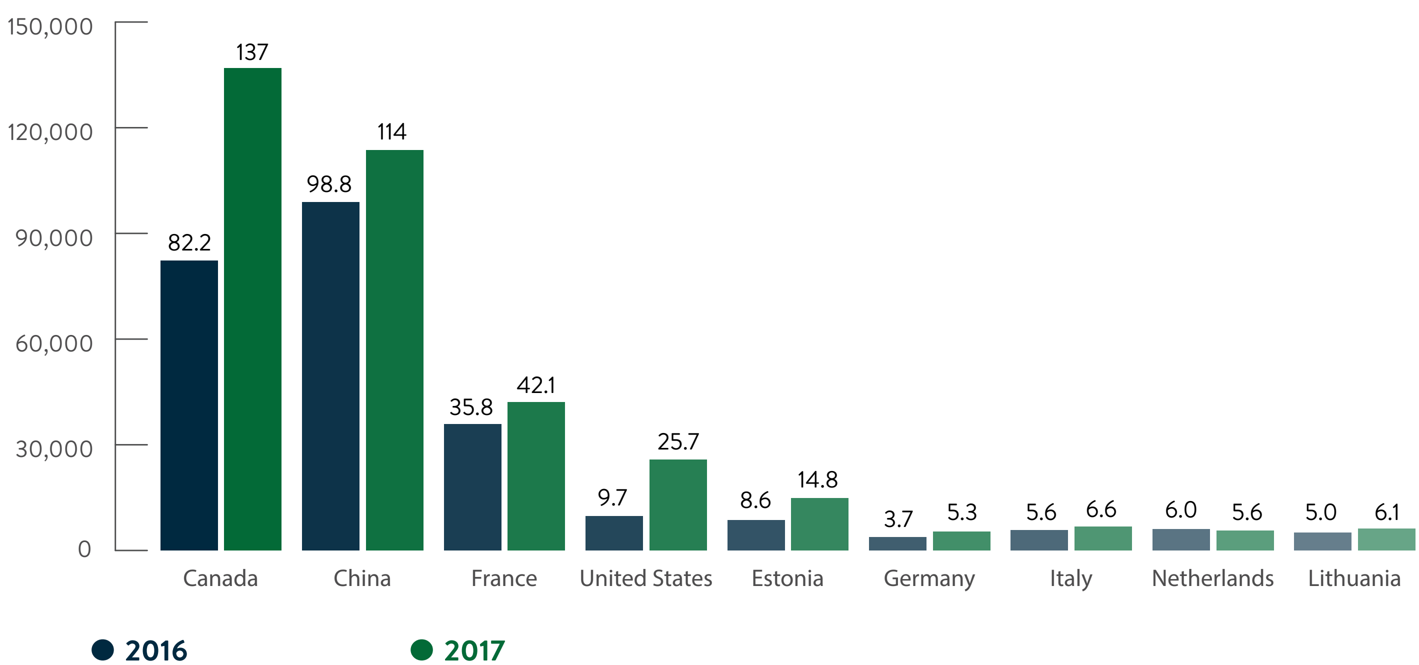
China planted approximately 113,000 acres in 2017, representing about a 15% growth from 2016. The extent to which cultivation is expanding in China remains unconfirmed, with many hemp cultivators preferring to remain anonymous due to fear of being falsely connected to illegal marijuana growing activities. While 113,000 acres of hemp cultivation was confirmed, a more accurate estimate may be as high as 200,000-250,000 acres. The China hemp market remains the global leader, driven by its domi-

DEVELOPED GLOBAL MARKETS: HEMP ACREAGE COMPARISON



Source: Nova-Institut and EIHA (European Union), Health Canada (Canada) and FOASTAT. Cultivation in China predates 2016, but historic data is sparse and inconclusive, and Hemp Business Journal *did not begin tracking until 2016.*

GLOBAL HEMP CULTIVATION LEADERS: ACREAGE



Source: Health Canada, EIHA, FOASTAT, Vote Hemp and Hemp Business Journal

nant textile market. The country is poised for explosive growth once the domestic extract market opens, and Chinese companies begin developing nutraceutical and pharmaceutical products with CBD.

While China and Canada are the oldest and most established hemp markets in the world, there are several up-and-coming disruptive markets. The United States recently passed the 2018 Farm Bill, with U.S. commercial cultivation expected to increase dramatically due to the historic legislation.

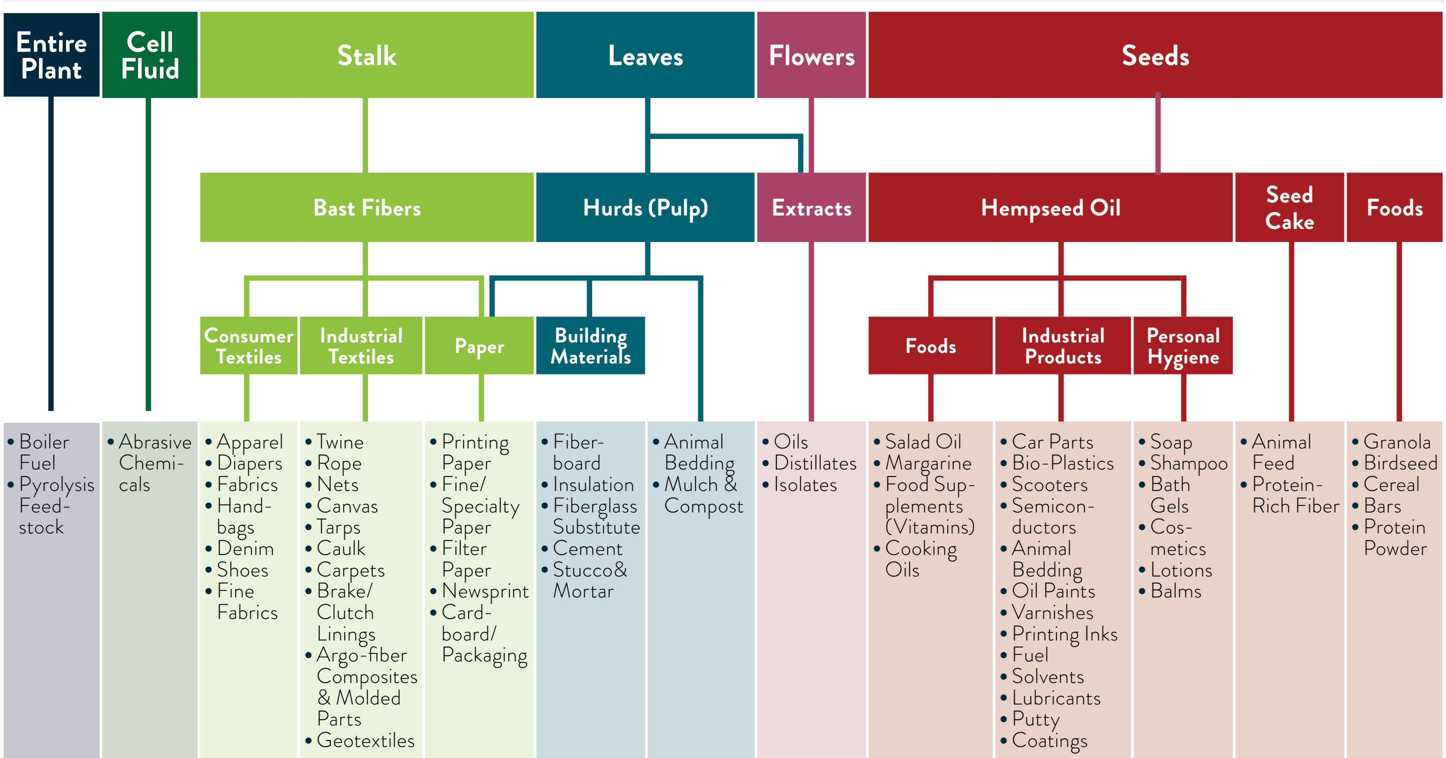
According to the European Industrial Hemp Association (EIHA), France led European cultivators with over 42,000 acres of hemp produced, representing a 17.5% increase in production from 2016. While France has consistently been Europe's hemp cultivation leader, in just two years Estonia has emerged to become Europe's second leading cultivator, followed by Italy, Lithuania, the Netherlands, and Germany, respectively. New Frontier Data predicts that France will continue to lead the European market as Germany grows to displace Estonia as Europe's second biggest cultivator by 2019.

Other leading cultivators around the world include Russia, Chile, and South Korea.

Global Hemp Sales

Hemp is a unique plant, with over 25,000 identified uses. Indeed, the uses and derivative products of hemp are so diverse that hemp globally intersects more markets and industries than any other crop.

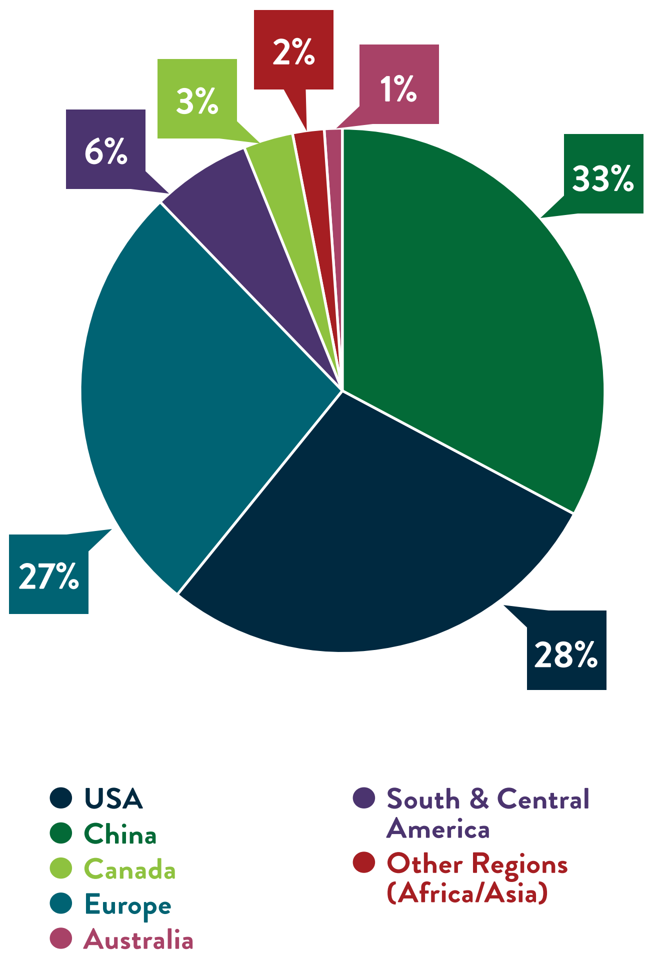
USES FOR HEMP



INDUSTRY SECTORS BREAKDOWN

Food	Supplements	Personal Care	Consumer Textile	Other Consumer	Industrial Applications	"Hemp" CBD
• Dairy • Bread • Grains • Beverages • Snack Foods • Packaged Foods • Prepared Foods • Condiments	• Dietary Supplements with hemp that do not contain CBD	• Soap • Beauty Products • Lotions • Balms • Salves	• Clothing • Uniforms • Socks • Blankets • Other	• Pet Food • Pet Supplements • Household Cleaners • Paper • Jewelry/Crafts • Other	• Automotive • Green Building • Industrial Textiles • Bedding Materials • BioFuels • BioPlastics • Oil Wells • Other	• Supplements • Topicals • Food/Drink • Pet Products

$3.7 BILLION GLOBAL HEMP-BASED PRODUCT SALES BY REGION 2018



Source: New Frontier Data

To assess the global hemp market, sales were aggregated from every country where commercially significant quantities of hemp products were sold. Import and export data were analyzed and benchmarked with national gross domestic product in countries where retail data did not exist. Retail sales data was collected in the United States from SPINS, and interviews of leading companies were conducted to assess consumer behavior and demand in major country markets.

The global market was analyzed across seven geographic regions:

1. The United States
2. Australia
3. Canada
4. China
5. The European Union
6. South and Central America
7. Africa/Other

Sales from each region were then analyzed across Hemp Business Journal's (HBJ's) seven industry sectors: Hemp Food, Industrial Applications, Consumer Textiles, Consumer Products, Personal Care, Hemp-Derived CBD, and other Supplements.

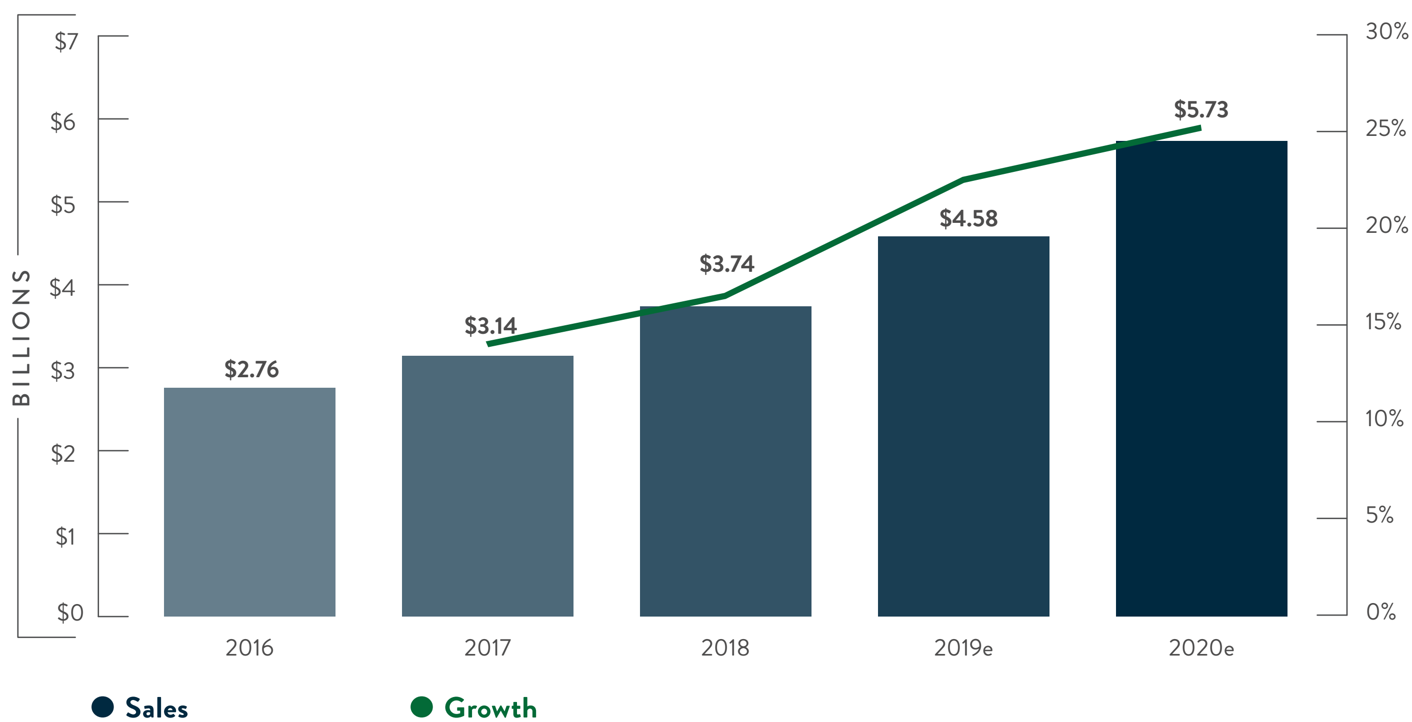
China led all countries with nearly $1.2 billion in sales in 2018, followed by the United States ($1.0 billion), Europe ($980 million), and South and Central America ($220 million).

In total, the global hemp market reached $3.7 billion in retail sales in 2018, with an annual growth rate of 15% driven by continued strength in Chinese textiles, European industrials, Canadian foods, and the U.S. hemp-derived CBD market. The hemp CBD market is expected to quickly expand and be the primary driver of global industry growth.

By 2020, the global market is expected to reach $5.7 billion across all markets, representing a three-year compound annual growth rate (CAGR) of 17.5%. The global growth in 2019 and 2020 is expected to be driven by the 2018 Farm Bill in the U.S., Epidiolex's going to market in the U.S. and Europe, Canadian licensed cannabis producers (LPs') entering the international hemp market, and the rise of the Chinese hemp CBD nutraceutical and supplement market.

Such convergent forces will propel the growth of hemp globally, and lay the foundation for a large, multisector industry, while leading other countries to include hemp within their agricultural economies.

GLOBAL HEMP SALES 2016-2020e



Source: Hemp Business Journal estimates ($ bil., consumer sales)

ABOUT NEW FRONTIER DATA

NEW FRONTIER DATA provides objective, rigorous and comprehensive analysis and reporting about the nascent and underserved cannabis industry worldwide. New Frontier Data's analytics and reports have been cited in over 80 countries around the world to inform industry leaders, investors, policymakers and others. New Frontier Data, the premier and only big data shop in the sector, looks beyond plant cultivation and distribution to raise the industry bar and improve visibility into what will inevitably soon be a mature and more complex global market. Founded in 2014, New Frontier Data is headquartered in Washington, D.C. and has additional offices in Denver, Colorado.

New Frontier Data does not take a position on the merits of cannabis legalization. Rather, its mission and mandate are to inform cannabis-related policy and business decisions through rigorous, issue-neutral and comprehensive analysis of the legal cannabis industry. For more information about New Frontier Data please visit: NewFrontierData.com.

Mission

New Frontier Data's mission is to elevate the discussion around the legal cannabis industry globally by providing unbiased vetted information and educating stakeholders to make informed decisions.

Core Values

- **Honesty**
- **Respect**
- **Understanding**

Vision

Be the Global Big Data & Intelligence Authority for the Cannabis Industry.

Commitment to Our Clients

The trusted one-stop shop for actionable cannabis intelligence, New Frontier Data provides individuals and organizations operating, researching, or investing in the cannabis industry with unparalleled access to actionable industry intelligence and insight, helping them leverage the power of big data to succeed in a fast-paced and dynamic market.

Editorial Team

Giadha Aguirre de Carcer, Founder & CEO
Publisher

Sean Murphy, Director of Hemp
Chief Editor & Report Author

John Kagia, Chief Knowledge Officer
Executive Editor

Carla Ooyen, Researcher
Report Author

J.J. McCoy, Senior Managing Editor
Report Editor

Beau Whitney, Senior Economist
Report Contributor

Laila Makled, Project Manager
Editorial Manager

HBJ EDITORIAL ADVISORS

Morris Beegle, Founder, *Colorado Hemp Co*
Chris Boucher, CEO, *Farmtiva*
Tom Dermody, Vice President of Operations, *Bija Hemp*
Bob Hoban, Managing Partner, *Hoban Law Group*
David Link, Managing Director, *JDB LightPath*
Wendy Mosher, CEO, *New West Genetics*
Zev Paiss, *Abraham Paiss & Associates*
Patrick Rea, CEO, *Canopy Boulder*
Sarah Syed, Marketing Director, *CV Sciences*
Eric Steenstra, President, *Vote Hemp*
Steven Turetsky, Managing Director, *Shi Farms*
Andrew Stoll, CEO, *OLMC*

NewFrontier data

HEADQUARTERS
1400 I Street NW / Suite 350 / Washington, DC 20005

SALES & MARKETING
535 16th Street / Suite 620 / Denver, CO 80202

info@newfrontierdata.com 844-420-D8TA

@NewFrontierData

Strength in Knowledge™

NEWFRONTIERDATA.COM

INTERCANNALLIANCE.COM

HempBusinessJournal
a division of New Frontier Data®

About Hemp Business Journal

Hemp Business Journal (HBJ) is the premier data publication for hemp. HBJ was acquired by New Frontier data in 2018. The insights shared in *The Global State of Hemp* are based on the most current expectations, estimates and projections as of the date such information was available. The market conclusions drawn are based upon a number of estimates and assumptions that, while considered reasonable by New Frontier Data and HBJ as of the time of such statements, are inherently subject to market fluctuations and business, economic, and competitive uncertainties and contingencies. HBJ's hemp industry estimates and analysis are meant to be fluid and will be updated if and when new insights and information become available. Each hemp report is exhaustively researched by our team of industry experts and presents an analysis of markets, trends, competition and strategy in the U.S. and global hemp industries.

METHODOLOGY

Data Overview

Data in this report are drawn from a variety of sources, including:

GOVERNMENT AGENCIES

We obtained data from global and country-specific agencies on topics ranging from census data and the rates of illicit cannabis use among various cross-sections of the population, to the policy and regulatory frameworks in place governing cannabis in various markets.

PRIVATE COMPANIES

Businesses operating in legal markets have been a critical source for insights into the growth and future of cannabis. In addition to sales data and product performance, interviews with business owners and staff have provided invaluable insights into the challenges and opportunities facing operators in the current market environment.

NON-GOVERNMENTAL ORGANIZATIONS

Current and historic data on cannabis and hemp cultivation, (such as planting area and production yield), as well as population and demographic data were gathered from the United Nations, its affiliated organizations, and other related organizations, including the Food & Agriculture Organization, the Organisation for Economic Cooperation and Development, the World Bank, and the African Development Bank.

ACADEMIC AND MEDICAL INSTITUTIONS

Research conducted by a broad range of academic institutions, medical centers, think tanks, and universities provided rich insight into issues surrounding the industry, such as the health effects of cannabis consumption, the potential medical applications, and the social and economic implications of cannabis prohibition and legalization.

SUBJECT MATTER EXPERTS AND POLICY GROUPS

In addition to the above sources, the New Frontier Data's perspective has been informed through extensive discussions with external stakeholders in the industry, including policy groups, advocacy organizations and entities outside the cannabis industry whose businesses are impacted by the advancing cannabis laws.

Market Projection Methodology

New Frontier Data has developed proprietary models for estimating the size of both the legal and illicit cannabis markets around the world. The models are continually refined based on new data inputs, expansion of legalization into new markets, changes in market regulations, and other market-disrupting events.

The growth models were developed based on analysis of key inputs including:

- Size and growth of the total population within each market;
- Size and growth of the adult population within each market;
- Usage trends of illicit cannabis use in each market;
- Monthly growth rates of adult-use sales in active legal adult-use markets;
- Size and growth of the tourism population in markets with adult-use and medical sales;
- Monthly growth of patient populations for each medical market since the activation of the medical programs;
- Number and types of qualifying medical conditions accepted in the jurisdictions which track patient registration growth;
- Monthly growth in medical cannabis sales in the jurisdictions which track this data;
- Monthly growth in medical cannabis expenditures per patient in the jurisdictions which track this data;
- Monthly growth in expenditures per person in adult-use markets which track this data;
- Interplay between medical and adult-use sales in markets where adult-use sales are legal; and
- Analysis of each market's regulatory model to identify similarities and differences in each market's structure.

DATA PARTNERS

SPINS is a leading provider of retail consumer insights, analytics reporting, and consulting services for the natural, organic, and specialty products industry; its business offerings are helping retailers in this high growth area to connect people with the brands that they need and love.

The Food and Agriculture Organization (FAO) is specialized agency of the United Nations that leads international efforts to defeat hunger. Its goal is to achieve food security for all and make sure that people have regular access to enough high-quality food to lead active, healthy lives. With over 194 member states, FAO works in over 130 countries worldwide. We believe that everyone can play a part in ending hunger.

The European Industrial Hemp Association (EIHA) is the largest hemp trade association in Europe. It formed itself as an association of hemp processing companies within the EU and has quickly expanded. Members are associations, national organizations, companies and individuals working in the field of industrial hemp or other natural fibers.

Vote Hemp is a national nonprofit advocacy organization dedicated to a free market for industrial hemp, low-THC varieties of cannabis, and to changes in current law to allow U.S. farmers to grow the crop. Vote Hemp's ultimate goal is having hemp grown on a commercial scale in the United States. The organization educates the public on the benefits of hemp farming and work with grassroots activists, legislators, businesses and family farmers to fulfill its mission.

THE U.S. MARKET

The American hemp revolution has begun.

After 40 years of hemp prohibition, the U.S. nationally legalized hemp through passage of the 2018 Farm Bill.

The 2018 Farm Bill was the culmination of years of effort to ease restrictions on hemp production. In 2015, Section 7606 of the Agricultural Act of 2014 (2014 Farm Bill, P.L. 113-79) established federal legislation to allow research institutions and state departments of agriculture to create pilot projects to cultivate hemp for research and commercial purposes. Since 2014, the pilot projects have quickly developed and expanded, with Colorado, Kentucky, and Oregon leading the market. On Dec. 20, 2018, President Donald Trump signed the 2018 Farm Bill, making hemp fully, federally legal and opening the domestic market under the auspices of the USDA.

In 2017, there were over 25,713 acres of hemp grown across 19 states. The states with the most dedicated acreage included Colorado, Oregon, Kentucky, North Dakota, and New York. The number of hemp producers in Oregon and Vermont more than tripled in 2017, while Minnesota, New York, and North Dakota respectively saw their numbers of producers grow by 533%, 425%, and 600%.

In 2018, an estimated 75% of all hemp grown was for CBD, versus 15% that was used for seed, and 10% for fiber. In states like Oregon and Vermont, nearly all cultivation was for hemp-derived CBD, while in

U.S. STATE CULTIVATION ACREAGE 2016-2018

State	2016	2017	2018
Colorado	5,921	9,700	21,578
Hawaii	1	1	2
Illinois	-	-	0.1
Indiana	2	5	5
Kentucky	2,525	3,271	6,700
Maine	1	30	550
Massachusetts	-	-	21
Minnesota	51	1205	710
Montana	-	542	22,000
Nebraska	1	1	0.5
Nevada	216	417	1,881
New York	30	2,000	2,240
North Carolina	-	965	3,184
North Dakota	70	3,020	2,778
Oklahoma	-	-	445
Oregon	500	3,469	7,808
Pennsylvania	-	36	580
South Carolina	-	-	256
Tennessee	225	200	3,338
Vermont	180	575	1,820
Virginia	37	87	135
Washington	-	175	142
West Virginia	10	14	155
Wisconsin	-	-	1,850
TOTAL	**9,770**	**25,713**	**78,176***

**Includes 10,090,188 square feet of greenhouse or indoor cultivation*
Source: Vote Hemp

states like Colorado, Kentucky and Montana, cultivators grew for CBD, seed, and a small amount for fiber.

In 2018, hemp cultivation boomed with 77,924 acres of hemp grown outdoors, and 10,090,188 square feet of hemp grown in greenhouses or indoors, representing a combined 78,176 total acres of hemp cultivation. Over 112,000 acres of hemp were licensed for cultivation. Forty universities conducted research, and 3,546 licenses were issued, according to Vote Hemp. Traditional industry leaders included Colorado, Kentucky, Oregon, and North Dakota, while newcomers included Montana, New York, and North Carolina. Montana saw a massive increase in cultivation going from 542 acres in 2017, to 22,000 acres in 2018.

“The 2018 Farm Bill normalized the industry, and leveled the competitive playing field for farmers and processors.”

The 2018 Farm Bill

The most significant legislation impacting the global hemp industry was Congress' passage of the 2018 Farm Bill. The law removed hemp from the U.S.'s Controlled Substances Act (CSA) and designated hemp as a legal agricultural commodity. For years, industrial hemp languished under prohibition in the U.S. while being grouped together with the higher-THC cannabis cousin, marijuana. While hemp production was prohibited in the U.S., other countries developed robust hemp industries, and became global leaders in the hemp market. Minor changes to U.S. hemp policies in 2014, 2016, and 2017 eased restrictions on the U.S. hemp market and increased U.S. production and acreage planted. The 2018 measure is viewed as a game-changer for the hemp industry, and immediately positions the U.S. to achieve a leadership position in the global hemp marketplace.

What makes the 2018 Farm Bill so significant is that it normalized the industry, and leveled the competitive playing field for farmers and processors. There are some key implications the passage of the Farm Bill has on the U.S. market.

- Hemp has been removed from the CSA, effectively eliminating the DEA from the equation and leaving the USDA as the primary regulator of hemp in the U.S.
  - *By decoupling hemp from the CSA and separating it from marijuana, investors and operators can operate hemp-related operations as normal businesses, and should eliminate the fear and risks associated with federal intervention by the DEA.*
- Hemp regulation as a crop is transferred to the state level versus the federal level.
  - *This eases restrictions on hemp and makes it easier for states to tailor rules to the local environment.*
- Farmers can get banking services.
  - *Prior to the passage of the Farm Bill, financial institutions were reluctant to provide normal banking services to hemp-related businesses. By differentiating hemp from marijuana, banks are more willing to offer banking services to hemp*

businesses, even beyond traditional checking and savings accounts. Another significant benefit is allowing credit and debit card processing services: While such financial services may not be offered immediately, banking and financial services are significantly less complicated in light of the reform legislation.

- The CBD market opens up, and will eventually enable interstate trade.
  - *While there are still more clarifications needed on the FDA policies, hemp products are considered an agricultural crop, and as such can participate in interstate commerce. More clarification is expected on this topic, and consultation with legal advisors is strongly recommended to fully understand the legal and regulatory environments.*
- Farmers are allowed to obtain crop insurance.
  - *The previous legal framework allowed for state pilot programs for hemp farming, but did not allow farmers to apply for crop insurance, thus adding risk and uncertainty to hemp investment and production. By enabling farmers to be insured, risks are reduced, and more investors will be willing to enter the space.*

While the normalization of the market is welcomed news by the U.S. hemp industry, there is also a ripple effect internationally. Countries such as China and Canada, which previously maintained competitive advantages in the hemp market, will now have significant competition within the U.S. market. With increased U.S. production, international hemp suppliers will have to begin to compete on both cost and quality in a U.S. market that previously was wide open. This increased competition will also drive more competition and require innovation and automation in order to create a competitive advantage that can be leveraged to open up new or untapped markets.

Passage of the 2018 Farm Bill will prove a boon for the U.S. hemp industry. It will increase cultivation acreage significantly, bring substantial banking and financial interests into the industry, and provide the necessary protections and framework to develop interstate commerce and federal programs under the USDA. Ultimately, it will mean more jobs and more innovation across the U.S. hemp industry. Such changes will help establish industrial hemp as another cash crop, through crop insurance and federal grants. As big agriculture enters the space in 2019, hemp is poised to become America's next great agricultural crop.

FDA and Its Role in the Hemp Industry, Post-2018 Farm Bill

While the Farm Bill introduced some certainty to the U.S. hemp industry, it did not eliminate all the legal and regulatory risks. Almost immediately upon the signing of the Farm Bill into law, the FDA published an update on hemp and CBD regulations. The update was mainly a reiteration of existing policies. Reactions varied widely as the updated guidance was interpreted and misinterpreted throughout the media and U.S. hemp industry. The FDA's role as it relates to the hemp industry is that it approves drugs, regulates food supplements, and monitors the food supply, particularly foods that are introduced to the market intended for interstate trade.

It is not uncommon for a regulator to reiterate a set of policies when new laws are passed, to remind the market that the existing rules remain in place until the new laws are assessed, and rules are adjusted in response to the new laws. It is important for investors and operators to understand the lag time between passing new laws and implementing new rules in response, so as not

to inadvertently violate a rule by mistakenly assuming compliance based on the new laws.

Michael McGuffin, the president of the American Herbal Products Association (AHPA), told New Frontier Data to expect the FDA to create some "conditions" for CBD products as the FDA develops a regulatory framework for such. McGuffin thought the conditions would include dosage limits and labeling requirements about material information on hemp CBD products, and that such conditions would be formalized within 6-12 months. Once the conditions are in place, the FDA would have the confidence and framework to regulate CBD products as dietary supplements, under the Dietary Supplement Health and Education Act of 1994 (DSHEA), and thus open the hemp CBD market to mass-market retailers.

Some main points from the FDA statement issued Dec. 20, 2018:

FDA Statement: Statement from FDA Commissioner Scott Gottlieb, M.D., on signing of the Agriculture Improvement Act and the agency's regulation of products containing cannabis and cannabis-derived compounds. FDA.gov/NewsEvents/Newsroom/PressAnnouncements/ucm628988

- The FDA asserted its authority to regulate hemp products that make claims of medical treatment;
- The FDA also stated that it would scrutinize any drug claims of therapeutic values for humans or animals, including for dietary supplements; and
- The FDA states that it is the regulatory body that determines what new food type can enter into the U.S. market.

QUOTES FROM THE FDA STATEMENT

"We're aware of the growing public interest in cannabis and cannabis-derived products, including cannabidiol (CBD). This increasing public interest in these products makes it even more important with the passage of this law for the FDA to clarify its regulatory authority over these products. In short, we treat products containing cannabis or cannabis-derived compounds as we do any other FDA-regulated products — meaning they're subject to the same authorities and requirements as FDA-regulated products containing any other substance."

"We continue to be concerned at the number of drug claims being made about products not approved by the FDA that claim to contain CBD or other cannabis-derived compounds. Among other things, the FDA requires a cannabis product (hemp-derived or otherwise) that is marketed with a claim of therapeutic benefit, or with any other disease claim, to be approved by the FDA for its intended use before it may be introduced into interstate commerce."

"It's unlawful under the FD&C Act to introduce food containing added CBD or THC into interstate commerce, or to market CBD or THC products as, or in, dietary supplements, regardless of whether the substances are hemp-derived."

While the FDA reiterated its position on regulating hemp-based products, it is in the process of

reviewing the new laws and adjusting regulations accordingly. There is a process to such, and that process takes time. Part of it includes receiving public inputs in the rulemaking process. The FDA announced in December 2018 that public inputs would be considered at some later point.

"Given the substantial public interest in this topic and the clear interest of Congress in fostering the development of appropriate hemp products, we intend to hold a public meeting in the near future for stakeholders to share their experiences and challenges with these products, including information and views related to the safety of such products.

We'll use this meeting to gather additional input relevant to the lawful pathways by which products containing cannabis or cannabis-derived compounds can be marketed, and how we can make these legal pathways more predictable and efficient. We'll also solicit input relevant to our regulatory strategy related to existing products, while we continue to evaluate and take action against products that are being unlawfully marketed and create risks for consumers.

While the process of rules development is in underway, it is critical for hemp operators stay abreast of the regulations, and to participate in the process. It will be critical during the interim period to seek legal advice prior to deploying new products or conducting interstate trade.

The signing of the Farm Bill is just the beginning of the process towards policy reform. While it creates a legal framework for the market, state and federal regulators are assigned the task to develop administrative laws to support the legal framework and create the rules for the industry to follow. While the benefits of the signing of the bill are significant, the roles that the state and federal regulators will play in the market will be a major aspect of the market to follow throughout 2019. The rules that are developed by regulators in 2019 will have a major influence on the development of the hemp industry for many years to come.

"Hemp-based CBD companies are still facing myriad banking and credit card related troubles. Removing hemp from the Controlled Substances Act doesn't necessarily mean banking challenges will just go away. There are many details and complexities related to banking. While we expect the payment networks to eventually be available to this market, there remains a potentially significant hurdle of educating compliance teams about any new hemp laws and regulations and how those may affect their ability to bank these operators. Financial institutions and their compliance teams are in many cases a slow-moving, risk-averse group. It will be at least a 6-12 month ramp-up period after the Farm Bill is signed before big banks are even making a decision whether or not to bank hemp CBD companies."

TYLER BEUERLEIN, EVP, HYPUR

Growing Hemp

Hemp is an annual plant that grows well in most parts of the United States, with the exception being desert conditions and high, mountainous areas. Hemp thrives in warm weather, and grows best in well-drained soils that are high in organic matter. Hemp seeds are sown directly where the plants are to grow, rather than in pots for transplanting. Hemp is typically planted after the average date the last frost has passed. Established hemp plants are fairly drought-tolerant, but the seedlings require irrigation for the first six weeks whenever the soil is dry. Hemp is typically harvested in 4-5 months after planting, and processed depending on its intended use for grain, fiber and/or CBD production.

Hemp Pricing and Profitability

Profitability of hemp depends primarily on what it is grown for. At present, the three primary purposes for hemp cultivation are: grain/seed, fiber, and cannabinoids (with a nearly exclusive focus on CBD by cultivators). The purposes for which hemp is cultivated dictate the method by which hemp is cultivated (and the resulting profitability on a per-acre and aggregate basis). There are two primary methods for hemp cultivation: row-crop and horticulture.

CULTIVATION METHODS AND SEED CATEGORIES

Row Crops:

In the row-crop cultivation method, hemp is grown like any other stand crop (such as corn). Seed is propagated and sewn. The advantage of this method is that it is far cheaper, and carries less risk when compared to the horticulture method of cultivation. The drawback, however, is that agronomic farming produces plants with a lower CBD content.

There are three types of row-crop seed categories.

GRAIN: Hemp seed is grown for three purposes: viable seed, non-viable seed, and de-hulled seed. A viable seed is one which is capable of germination and growing under suitable conditions. Non-viable seed is processed by pressing for oil, thus rendering it non-viable for import or export. De-hulled seeds are primarily used for food production. According to Tom Dermody of Bija Hemp, viable seeding density is 23 lbs. to 28 lbs. per acre, which produces an average density of 561,000 plants per acre.

FIBER: Viable hemp seed planted for fiber/hurds typically yields less than 2% CBD. Planting density is twice that of grain, and results in very tall and low flower-producing crops. Seeds are sewn at an average density of 1.2 million plants per acre.

MID-RANGE OR MULTI-CROP: Seeding density for multi-crop growing is slightly higher than grain, but lower than fiber, and harvested just prior to seed development. Planting a multi-crop results in a higher flower yield with a CBD content between 2%-8% CBD, and as high as 15%, providing the greatest opportunity for experimentation and potential profitability for farmers as both CBD and fiber/hurds can be harvested depending on the cultivar and agricultural management practices. Seeds are sewn at an average of 600,000 plants per acre.

Hemp grain can sell between $0.60 to $0.65 per pound, and on average, hemp farmers get about 1,100 lbs. of hemp grain per acre. After taking into account cultivation costs, which can range from

$300 to $350, farmers can earn $250 to $300 per acre. "Historically this has been the case, but the explosion around CBD is driving planting seed prices upwards. Based on some of the information we've seen of late, we believe the (retained) seed pricing will increase as well," said Tom Dermody, vice president of operations for Bija Hemp.

Similarly, hemp fiber sells for approximately $275 per ton. On average, hemp crops can yield between 4 and 5 tons of hemp fiber per acre, which means after costs farmers can make upwards of $480 per acre in profit. Much of the fiber market depends on the proximity of specialized processing capacity, and at present there is little in the emerging U.S. market, meaning few farmers planting for fiber and making such profits.

Horticultural Cultivation

The second cultivation model is the horticultural method. In this model, hemp is grown in a manner similar to marijuana. Growers using this method will often use the term "short, bulky Christmas trees" to describe their crop. The advantage to this model is that farmers get significantly higher yields of CBD given the density of flower per plant. The drawback to the horticultural model is that it is more expensive, and not yet scalable for most farmers. The horticulture model relies primarily on clone propagation (versus seed propagation), which is also more expensive to do, and difficult to scale. Clone propagation describes planting seedlings (instead of seeds).

HIGH CBD: Viable seeding typically yields plants of greater than 10% CBD, and one-half or 1 pound of flower acquired per plant. Full-grown plants are short and bushy, with a focus on maximizing flower production. High-CBD hemp plants often resemble marijuana plants.

> **"The anticipated decline in prices makes it critical for hemp producers to prepare for where prices are headed, not where they currently are."**

Under the horticultural method, plants are grown significantly farther apart than under the row method, with only 1,600-2,200 plants per acre.

Depending on the state, circumstances, and cultivation method, cultivating hemp for CBD can generate anywhere between $2,500 and $40,000 per acre — a truly extraordinary range due to the variance in flower prices across state markets. Over time, as a national program emerges, the market will stabilize and prices for seed and flower will fall. Therefore, the significant margins enjoyed in the highest-cost markets will quickly fall toward the lower end of the range.

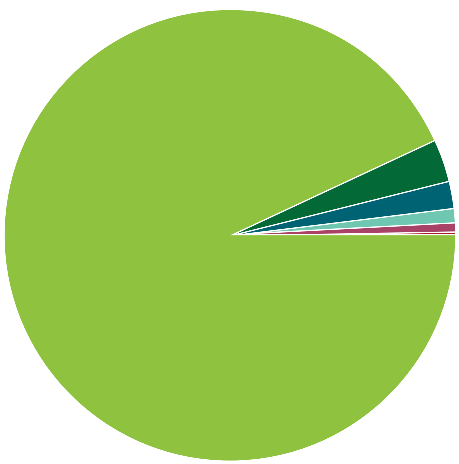
The anticipated decline in prices makes it critical for hemp producers to prepare for where prices are headed, not where they currently are. Indeed, all hemp growers should anticipate that as hemp producers build scale, prices will continue to fall below their current levels, even in the lowest-cost markets.

SEED IMPORTATION DECREASING

Until recently, imported hemp seed dominated the U.S. market, but market share has gradually shifted to locally grown seed as American producers have built scale. The classifications of hemp seeds fall under HS 12079903205, defined as "hemp seed, whether or not broken" with a standard measure of quantity in kilograms. This definition includes three forms of hemp seeds: viable whole seed, non-viable whole seed, and de-hulled seeds.[1]

U.S. imports of hemp seeds have decreased significantly from all-time highs in 2016 of 39,285,634 lbs.[2] In 2017 there was a 57% decrease in seed imports from 2016, and the first half of 2018 put the import market on pace for a 20% decrease. The downward trend continued through 2018 as the U.S. hemp grain market continued to mature.

GLOBAL HEMP SEED IMPORTS TO THE U.S.



Source: U.S. Census Bureau Economic Indicators Division USA Trade Online, U.S. Import & Export Merchandise trade statistics ($U.S. Customs Value). Harmonized System hemp seed code: Hemp seed codes 12079903205

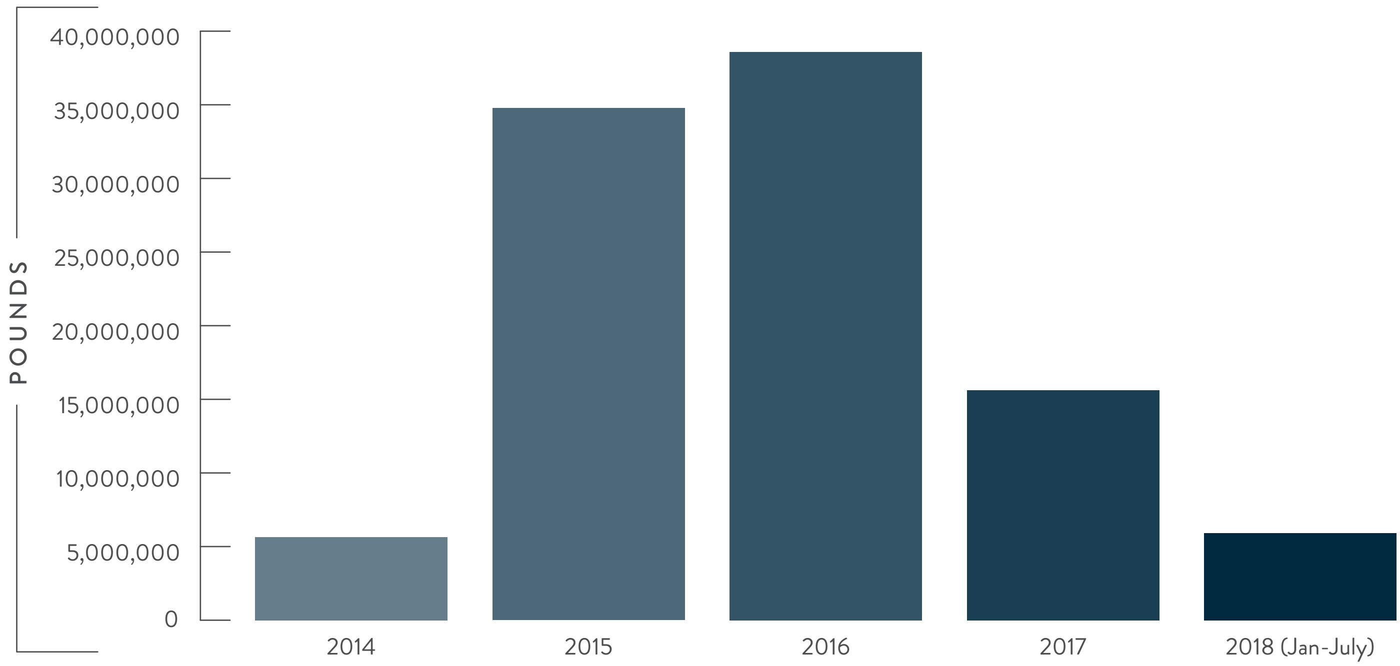
While total imports can include viable, non-viable, and de-hulled hemp seeds, industry sources estimate that more than 80% of this figure is comprised of de-hulled hemp seeds (also called hemp hearts) with viable whole hemp seeds comprising 15% to 18% of imports, and non-viable whole seeds representing a marginal amount. Most de-hulled hemp seeds and hemp hearts come from Canada and enter the U.S. through Pembina, North Dakota. The hemp industry's largest conglomerate, Fresh Hemp Foods, has a branded consumer products division called Manitoba Harvest (based in Winnipeg, Manitoba), and an ingredients division called Hemp Oil Canada (based in Ste. Agathe, Manitoba), which account for a significant majority of all non-viable seed imports. The viable seed that entered the U.S. in 2017 and in 2018 is almost exclusively from Europe and Canada.

Importation of viable seeds is subject to DEA oversight, and requires DEA registration according to

U.S. HEMP SEED TOTAL IMPORTS: 2014-2018 (LBS.)

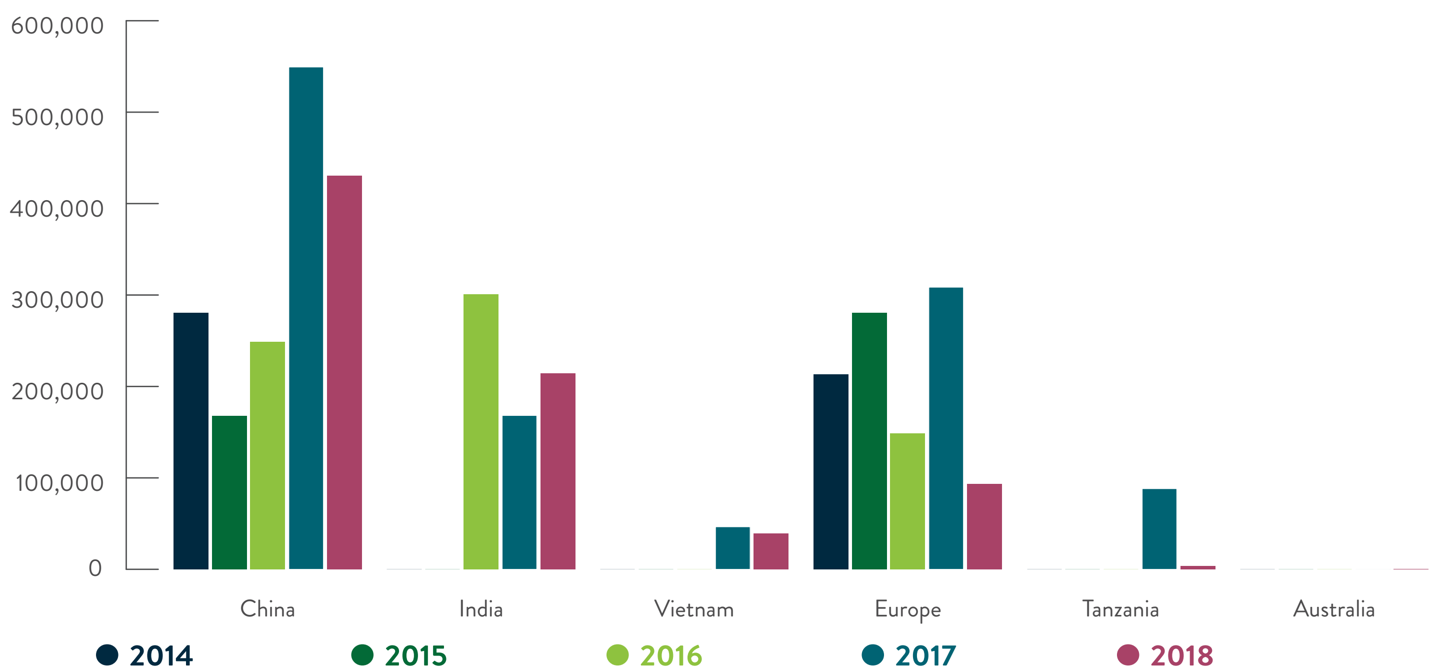
Year	2014	2015	2016	2017	208 (Jan-July)
Hemp Seeds (HS 1207990320)	6,135,621	35,222,674	39,285,634	16,768,609	6,692,136

U.S. SEED IMPORTS FROM CANADA (LBS.)



Source: U.S. Census Bureau Economic Indicators Division USA Trade Online, U.S. Import & Export Merchandise trade statistics ($U.S. Customs Value). Harmonized System hemp seed code: Hemp seed codes 12079903205

GLOBAL HEMP SEED IMPORTS TO U.S. IN LBS. (CANADA EXCLUDED)



Source: New Frontier Data

> **"We can provide a high level of assurance to the performance of our seed. At the rate we are going we will supply over 20% of the global hemp seed market by the 2020-2021 planting season."**
>
> TOM DERMONDY
> VP OF OPERATIONS, BIJA HEMP

the Controlled Substances Import and Export Act (CSIEA, 21 U.S.C. §§951-971).[3] While certified seed programs remain in their infancies, several companies are successfully importing viable seed from international cultivars, including Bija Hemp.

Canada remained the leading exporter of seed to the U.S. market, accounting for 93% of all seed imports in 2017. China was the second-largest importer in 2017, representing 3.5% of the import market. Comparatively, imports from several European countries and India were negligible relative to Canada. Vietnam and Tanzania both registered their first exports to the U.S. in 2017. Australia also joined the exporter ranks with 20 lbs. imported in the first half of 2018.

The U.S. Wholesale Market

UNDERSTANDING HEMP BIOMASS

While the emerging global wholesale market for seed and fiber varies widely across countries and regions, the U.S. market is beginning to develop its biomass and flower market. Hemp biomass defines the entire crop — the cumulative mass of a farmer's hemp crop including all stocks, stems and leaves, and for some farmers, flower — that will be processed for derivative products. Hemp biomass remains the dominant wholesale transaction between farmers, brokers, and processors. Industrial farmers, especially those growing a multi-crop variety, find it much easier to sell their crop for its cumulative biomass product to companies capable of processing both fiber and extract, resulting in a more seamless transaction between farmers and processors.

Two primary pricing variables impact the legality and pricing for hemp biomass. First and foremost, the biomass crop must be tested and cannot be "hot," the industry's term for a crop that tests over 0.3% THC on a dry weight basis. For hemp biomass to be a legal product, it must meet the legal definition of hemp.

Secondly, the CBD potency of the aggregate biomass is very important. Again, this is where horticulture and agricultural growing models differ. In horticulture, there will be less biomass on a per-pound basis, but a greater amount of flower, giving a higher cumulative CBD potency for the biomass. Conversely, the agriculture model will yield much more biomass on a per-pound basis, but given it will have more stock and stems (and less flower), the aggregate CBD potency of the biomass will be much lower. Farmers must consider numerous inputs in determining what kind of biomass they will grow, including seed variety, cultivation technique, and harvesting equipment that all yield differences in aggregate biomass volume (pounds of biomass) and CBD potency (ranging from 2%-15%).

Hemp biomass is measured in pounds per acre where there is a dollar value assigned for percentage of CBD per pound. The percentage of CBD per pound is the aggregate potency for the crop, and dictates what the farmer can expect to make on it

when sold. Pricing in 2017 and 2018 ranged widely, from $2.50-$5.00 per pound of crop containing 2%-15% CBD. Futures contracts typically ranged from $2.50 to $3.50 per pound, while spot pricing ranged between $3.00 and $5.00 per pound.

The CBD percentage of a biomass product transaction is extremely important. Crops with less than 3% CBD are often too low for extractors and processors to accept, because a processor will incur costs to process a high volume of biomass and yield less final product — thereby resulting in production-cost inefficiencies. It simply does not make sense for processors to extract CBD from a 2% CBD crop. Conversely, a biomass crop with a high CBD percentage – from 8% to 15% – will fetch a premium, closer to $3.50-$5.00 per pound, because extraction is easier and more efficient.

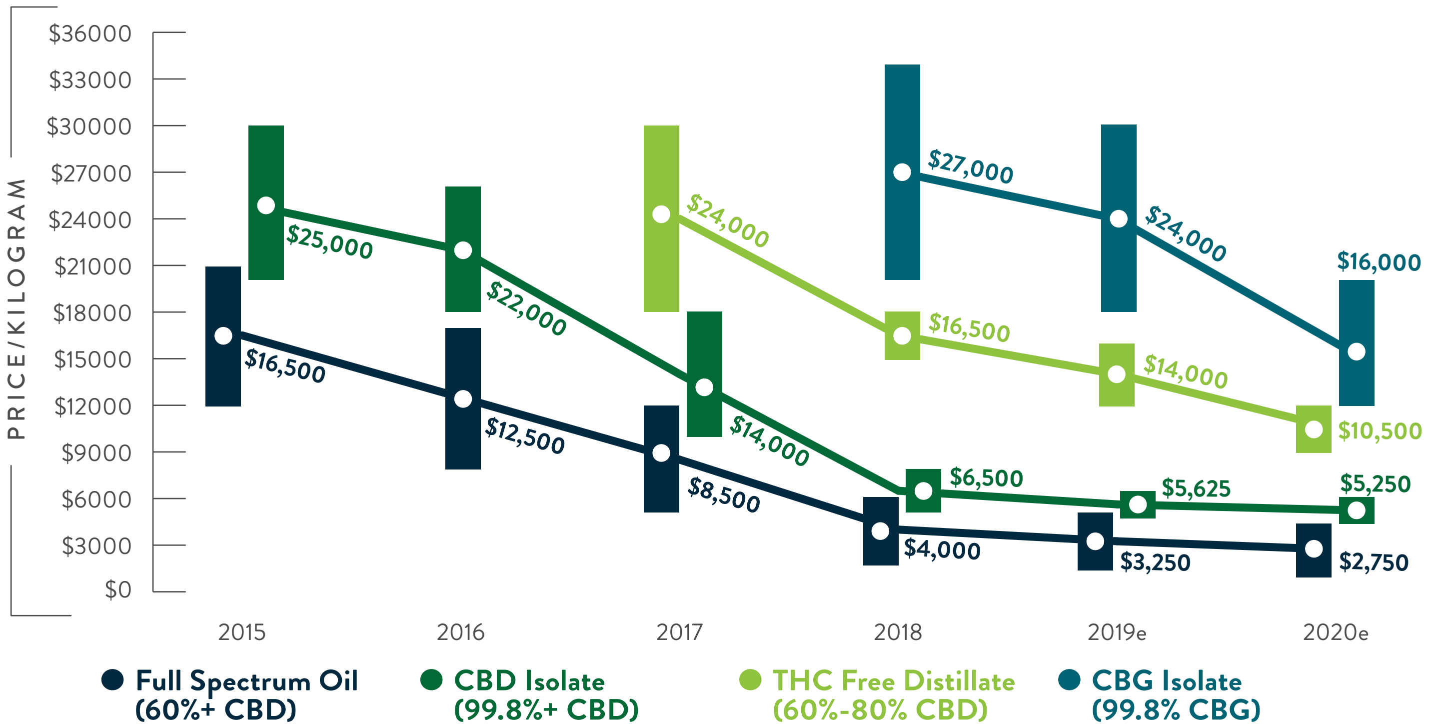
As farmers consider what type of hemp crop to grow, it becomes reasonable to grow a crop that balances the aggregate volume of the biomass, maximized by agricultural scaling inputs, and the highest potency of CBD in the crop to maximize processing efficiency and output costs. Consider that a 6%-10% CBD multi-crop (grown by the agricultural method) yields the greatest amount of aggregate biomass (of fiber and CBD) while maintaining a high enough potency of CBD to meet processing efficiencies to reduce costs and maximize scale.

FLOWER

While traditionally a wholesale product used to create extracts and isolates, hemp flower surged in 2018 as a retail market with increased demand by consumers for flower with a high CBD concentration. The growing demand is fueled by smoke shops, headshops and tobacco consumers looking for an alternative smokable or vape product. Instead of visiting a dispensary in Colorado and buying a marijuana flower product, consumers in states like Oklahoma and Tennessee are visiting dispensary-like shops (without any THC products) and buying CBD flower. Such increased demand for CBD flower has raised prices across the industry as farmers look to close the existing supply-demand gap.

> **“Increased demand for CBD flower has raised prices across the industry as farmers look to close the existing supply-demand gap.”**

In 2017 and 2018, flower pricing ranged widely across the U.S., from $25 per pound to over $250 per pound with concentrations averaging between 6% to 20% CBD. As is usual in new and emerging markets, discounts are being given for larger orders. HBJ anticipates that the CBD flower market will begin to mature through the next two to five years, and will see price declines like those seen in the marijuana market in the past three years. But until that time, prices will vary considerably, and opportunities abound for farmers with CBD flower buyers.



Source: Hemp Business Journal

CBD WHOLESALE PRODUCTS

Processed CBD wholesale products are generally being bought and sold in three forms: full spectrum oil, isolates, and THC-free distillate. Extracts can come in a variety of forms, including crude (an unrefined form of extract typically less than 50% CBD), and refined extracts including full spectrum oil (FSO), typically more than 50% CBD, and THC-free distillate, typically between 60% and 80% CBD. Isolate products are typically greater than 99% CBD.

Pricing remains largely dependent on the concentration of CBD present in a wholesale product. Consider, for example, that 1,000 grams of extract with a CBD concentration of 10% contains 100 grams of isolate CBD, and another product with 10,000 grams of 1% extract also contains 100 grams of CBD. Both products are priced purely on the total CBD contents, and thus will be priced the same, despite there being a considerable difference in volume of the product being sold.[4]

Yet, it is not possible to establish pricing based solely on CBD as the active ingredient in hemp. There are other factors and inputs involved in buying and selling wholesale CBD products, including organic certifications, contract size, transportation costs, and more. As the market matures, and more purchase contracts are analyzed, it will be possible to develop an accurate pricing index for CBD. Until that time, New Frontier Data has established historical price ranges for CBD wholesale products by reviewing contracts and pricing sheets, and conducting interviews with leading processors, producers, and brokers.

The data above assumes a single order of 1-10 kilograms of the given wholesale products. Pricing discounts (not charted) were common for recurring orders, future contracts, and/or large and bulk orders. Markets are developing for other cannabinoids (CBG, CBN) and terpenes, and opportunities abound for operators who can capture such markets.

Order Size Table for Isolate

- Small orders: 1 gram to 1 kilogram
- Medium order: 1 kilogram to 10 kilograms
- Large orders: 10 kilograms to 100 kilograms
- Bulk orders: 100+ kilograms

PRICING VARIABLES: QUANTITY AND QUALITY

QUANTITY remains the dominant pricing variable, with discounts being standard for medium-to-bulk-size wholesale orders. Throughout 2017 and early 2018, the wholesale market experienced a tide of brokers representing large and bulk orders, often in excess of 100 kilograms of isolate for a single order. The orders were illegitimate, with brokers and buyers using a high order quantity as a negotiation tactic to gain leverage to drive down prices. Large orders are growing, but bulk orders remain rare. Only a half-dozen U.S. companies have the processing capacity to even meet bulk orders.

New Frontier Data anticipates that several dominant processors will emerge during the next three to five years, at which point the pricing for large and bulk orders will begin to stabilize. Such processors will have the capacity to produce large quantities of FSO, THC-free distillate, and/or isolate at a high quality with Good Manufacturing Practices (GMP) certification – a production standard required to import medical CBD products into most countries. Until major industrial processors are established in the U.S., Canada, Europe and China, the pricing for an order will remain largely negotiable, with no established pricing across industry players.

QUALITY of the product also factors highly into pricing with producers and processors reporting the quality of the source material, based on a Certificate of Analysis (COA) as the dominant factor of quality. Cannabinoid and terpene profiles remain the key measure of quality in a COA. The presence of pesticides is an important factor in pricing. The origin of the hemp material also factors into the wholesale price for CBD products, with premiums still being given for American-grown "single-source" hemp where the quality of the source material is often higher and more consistent, and where no importation costs were incurred.

Lastly, and importantly, production costs are a pricing metric that varies across processors. The daily production capacity varies based on several factors including daily CBD production, input costs for extraction equipment, and labor. Processors with high-capacity equipment, achieving a low cost of production relative to competitors, will have strong long-term advantage as volumes increase and prices decline.

Readers should note, there are several vertically integrated hemp companies that do not rely on third-party processors. They do all their own processing, and are not subject to the market fluctuations for wholesale product prices created by supply and demand between supply-chain players. Vertical integration, when effectively implanted at scale, is a strong competitive advantage.

Overview: U.S. Retail Sales

The total sales for the U.S. hemp industry in 2018 was $1.1 billion. Among those sales, $390 million were from hemp-derived CBD products, $198 million for personal care products, and $150 million for hemp food products.

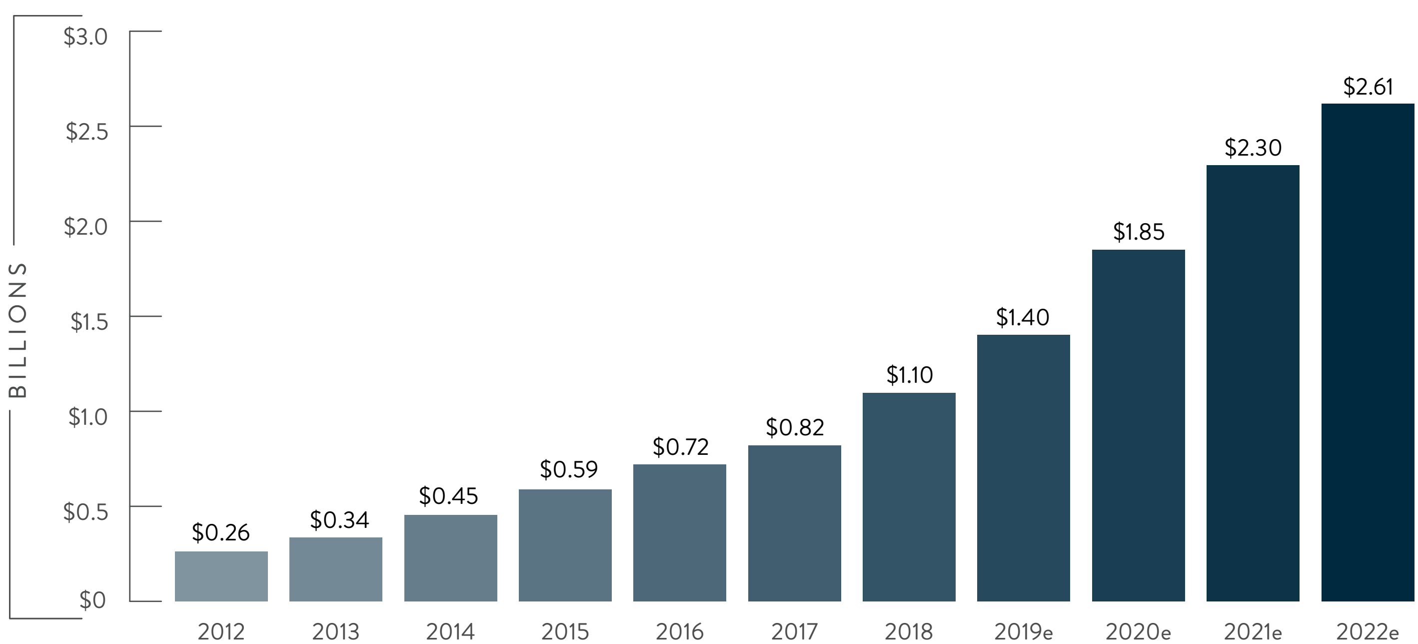
The U.S. hemp industry grew 34% in 2018. The hemp industry was bolstered by explosive growth in the hemp-derived CBD category (a category that did not exist five years ago). By 2022, the hemp industry will grow to be worth $2.6 billion in sales led by hemp-derived CBD, food, personal care, and industrial products. Hemp-derived CBD and industrial applications are expected to lead all retail sectors.

As legal and regulatory barriers are removed by implementation of the 2018 Farm Bill, and consumer education spreads, New Frontier Data estimates that the U.S. hemp industry will grow at an estimated five-year CAGR of 19% (2018-2022).

HEMP CBD

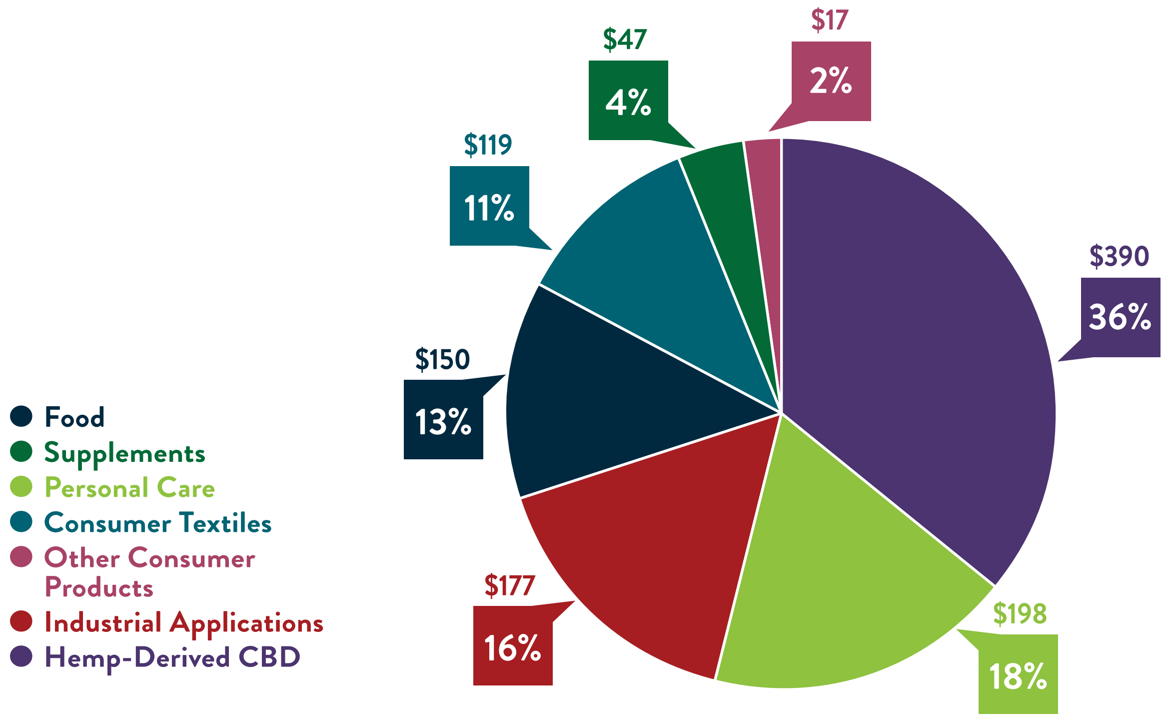
NOTE: New Frontier Data and Hemp Business Journal provide in-depth analysis of the total CBD market – across hemp-derived, marijuana-derived and pharmaceutical CBD – in our industry-leading study, *The CBD Report*. The following is a brief summary of the report's updated findings. For a detail analysis of the CBD market, please see the CBD report available at: NewFrontierData/CBD.

U.S. HEMP-BASED PRODUCT SALES 2012-2022e



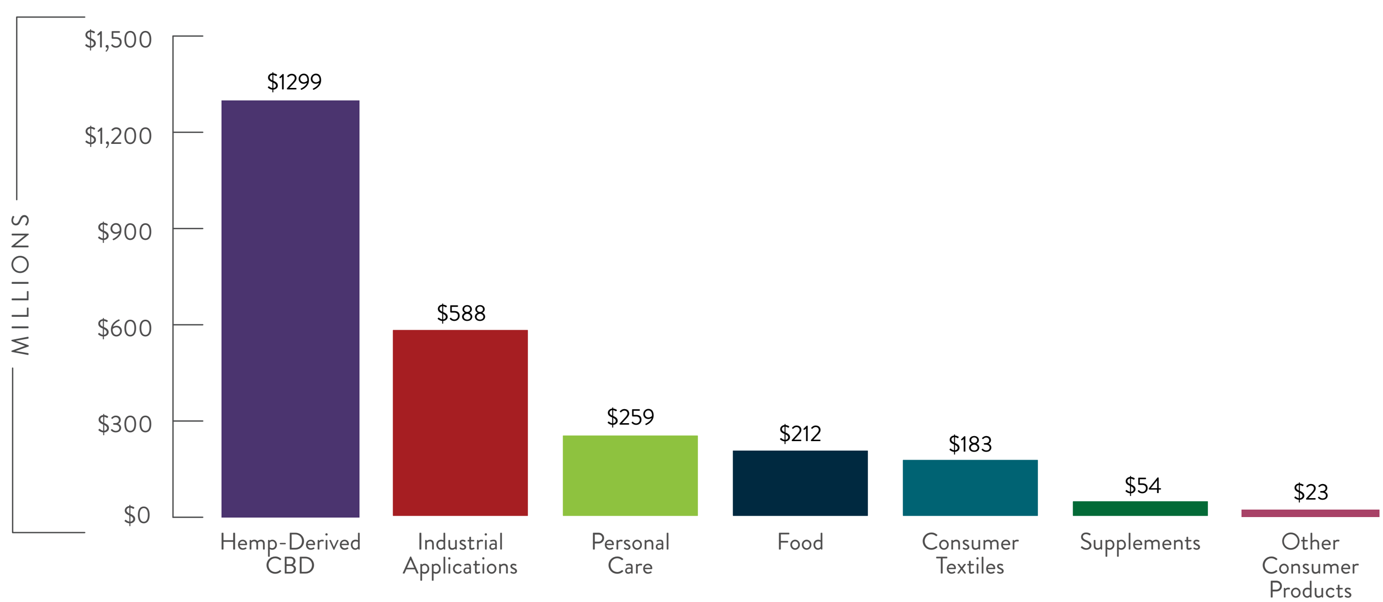
Source: Hemp Business Journal *estimates ($ bil., consumer sales)*

$1.1 BILLION U.S. HEMP-BASED PRODUCT SALES BY CATEGORY IN 2018



Source: Hemp Business Journal *estimates ($ mil., consumer sales), SPINS*

$2.6 BILLION U.S. HEMP-BASED PRODUCT SALES BY CATEGORY IN 2022e



Source: Hemp Business Journal *estimates ($ mil., consumer sales)*

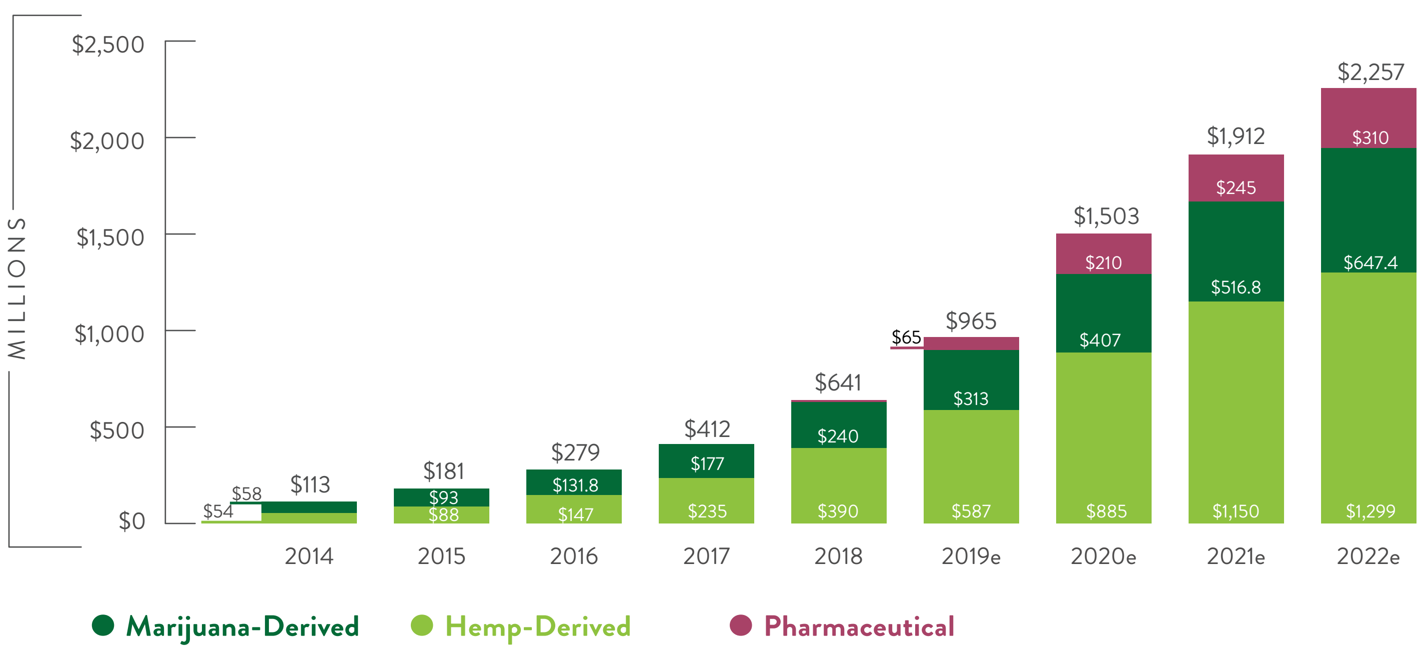
Hemp CBD is the leading sector in the U.S hemp industry, and is driving broad industry growth. For hemp-derived CBD market estimates in this report, included are CBD products meeting the definition as hemp-based (less than 0.3% THC).

Hemp-derived CBD is soaring in popularity. The total U.S. CBD market in 2018 accounted for $641 million in retail sales across hemp-derived and marijuana-derived sources growing at a 56% annual growth rate. New Frontier Data estimates that the total CBD industry will grow to be worth $1.5 billion by 2020, and to $2.2 billion by 2022. The 2018 Farm Bill will be a catalyst for growth. Depending on the adoption rate among mass market retailers (Walmart, Target, Kroger, Amazon/Whole Foods Market) the hemp CBD market is estimated to reach a $1.3 billion market by 2022, and may explode to a $1.5 billion to $2.5 billion market depending on the speed at which regulations are eased (by the FDA) and mass-market retailers put hemp-derived CBD products on their shelves and online (e.g., Amazon).

CBD is a non-psychoactive cannabinoid offering wellness effects for many medical indications including pain, anxiety, and epilepsy. As such, significant opportunities exist for mass commercialization of CBD products. A wide range of potential applications (from nutritional supplements to pet food) will propel hemp-derived CBD products into mass-market retailers in the coming years.

Hemp-derived CBD's low-risk profile creates the potential to make it a nutritional additive similar to

U.S. TOTAL CBD SALES BY CHANNEL



Source: Hemp Business Journal *estimates ($ mil., consumer sales), SPINS, BDS ANALYTICS*
All pharmaceutical sales are for the drug Epidiolex.

vitamins and minerals commonly added to processed foods. As federal and state governments decouple regulations governing CBD from those governing psychoactive cannabis, the ability to sell CBD products in conventional retail outlets will quickly expand consumer access, and the ability to source CBD both from high-THC cannabis and from hemp will enable the cost of CBD to fall more quickly than that of THC.

HEMP FOODS

New Frontier Data estimates that hemp food sales reached $150 million in 2018, and will expand at an average annual rate of 11% between 2019 and 2022. As one of the most mature hemp markets in the U.S., growth is slower than in other emerging categories; however, growth still significantly outpaces the total food market, and even the growth of the organic food industry.

Hemp-based food product sales accounted for 13% of hemp consumer sales in the U.S. in 2018, a share expected to shrink to 8% by 2022 as many of the hemp industrial applications become more established in the U.S.

The hemp food market remains a small segment of the natural foods industry. According to 2017 estimates from Nutrition Business Journal, total sales of natural products industry passed $200 billion, which equates to a nascent penetration of about 0.4% for hemp.

Natural and specialty retail outlets, including chains such as Whole Foods and Sprouts, are currently the most popular places to purchase hemp food products, with estimates that they contributed about 70% of the 2017 hemp food sales. That channel has been carrying hemp products for many years, and customers are familiar with the offerings; thus, future growth in this channel is expected to be slower, but steadier, than other channels.

> **“Nutiva has always been a market leader in hemp foods. I recently founded RE Botanicals to shake up the fastest growing category in the hemp market – CBD. RE Botanicals is on track to be in 1,000 retailers by the end of July. We are gaining incredible speed now that we are USDA certified-organic and the Farm Bill has been passed.”**
>
> JOHN ROULAC, FOUNDER, NUTIVA AND RE BOTANICALS

Hemp foods have only been introduced to the mass market on a (product relative) large scale in the last few years, helping to drive the strong growth through 2015, but sales of hemp-based products in the snack category stumbled in 2016 and 2017, causing an overall slump in hemp food sales growth.

Direct sales channels are often a good way for new companies to enter the market and gain a small following, and the internet is overall the fastest-growing channel for natural product sales. Such are estimated to continue to account for only a single-digit percentage of hemp food sales.

Hemp seeds are being incorporated into a wide variety of food products.

- In the breads and grains category, inclusion in cold cereals has driven double-digit growth, impressive for a category where overall natural and organic cereal growth has remained in the low single digits for many years. Cold cereals are the fourth-largest food subcategory in mass-market retail, and the third-largest in the natural retail channel.
- Hemp milk is the second-biggest category of hemp food products (falling just behind seeds and seed-based snacks), with consumer interest in dairy alternatives helping to keep growth strong.
- Hemp seeds and snacks using those seeds, including nutrition bars, are the biggest category of hemp food sales, accounting for approximately 45% of sales. They have experienced ebbs and flows of growth over the last few years, but are unlikely to lose their dominance in the hemp market anytime soon.
- Among packaged foods, meat alternatives (think hemp burger) are the biggest source of hemp food sales and growth as consumers continue to look for more meatless burger options.
- While hemp products have been introduced in the dairy section and in condiments, sauces, and oils, such products have not gained consumer acceptance, and remain an almost negligible portion of the hemp foods market.

SUPPLEMENTS

Dietary supplements that include hemp (but not CBD) are estimated to have contributed $47 million in consumer sales to the hemp market in 2018. The majority of such products are protein supplements, or non-CBD hemp oils. The popularity of hemp protein continues to be tied closely to increasing consumer interest in healthier, vegan protein options. The hemp supplement market is very small compared to the overall supplement market, which according to Nutrition Business Journal reached $41.2 billion in 2016 on 6.0% growth. Approximately 4 out of 5 hemp supplements are sold in the natural and specialty channel. Penetration of the products in mass market channels remains at only about 10% of all sales.

Growth of hemp supplements was slow in 2018 at only 2.1% — all the growth was in the sister category, hemp CBD. New Frontier Data anticipates this category and hemp CBD to merge over the coming years as nearly all hemp supplements will contain CBD, and the exceptions that do not contain CBD will represent a smaller and smaller percentage of a rapidly growing category.

OTHER CONSUMER PRODUCTS

An array of personal care products with hemp in the ingredient list are currently for sale in the U.S., from hair care to lotions, bath soap to deodorant. Given hemp's antibacterial properties, soaps with hemp continue to be the most popular personal care category, and gained more mass-market appeal than other hemp product categories. New Frontier Data estimates that hemp-based personal care products sales grew by 8% in 2018, to $198 million. That growth was relative to the entire natural and organic personal care and household products market, estimated by Nutrition Business Journal to be close to $20 billion in 2017. New Frontier Data estimates that about 1 of every 3 hemp personal care products is being sold in mass-market channels.

The hemp consumer textiles industry — including apparel items and household products like purses and backpacks — is estimated to contribute more than $100 million in consumer sales to the hemp market in 2018.

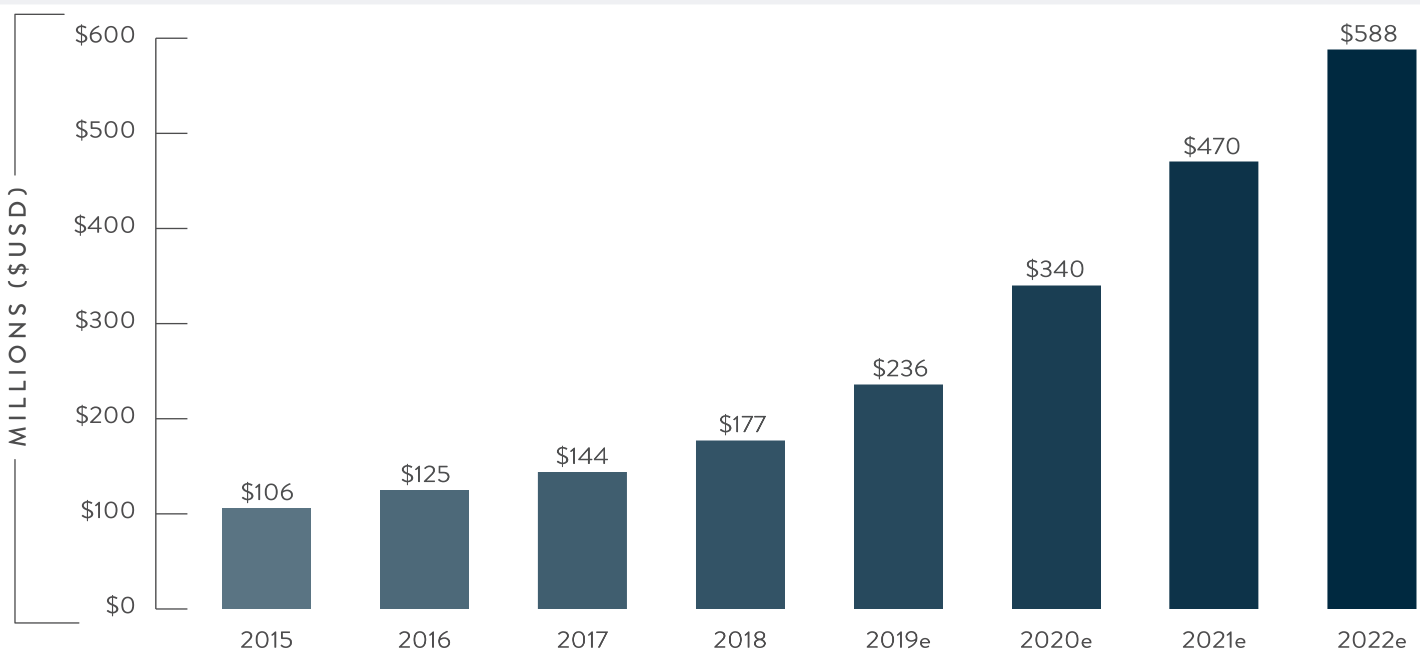
Other consumer products containing hemp include pet food and supplements, house cleaners, cigarette paper, traditional paper products, and jewelry and craft items such as twine and rope. The other products are estimated to have contributed another $17 million to the hemp industry in 2018, and remain the smallest product niches.

Rawganique, based in Blaine, Washington, offers a wide range of fiber-based products. Its most popular hemp products include ropes, twine (for do-it-yourself artists and gardeners), and fabrics for people who make their own clothes. Among finished products, "the hemp shower curtains have always been very popular, and our hemp socks and shoes because we are the only ones making such a wide range of hemp shoes," according to Qeanu Aidan, Rawganique's CEO and founder. Rawganique continues to rely on European supply for products because U.S. manufacturing is so limited for hemp fiber products. "We have to work in Europe, there is no alternative. We would do (it in the U.S.) tomorrow if it was realistic. It is very important to us to make things as local as we can."

INDUSTRIAL PRODUCTS

New Frontier Data predicts that sales of hemp-based industrial products will post the strongest growth over the next five to 10 years. Hemp-based

U.S. HEMP: INDUSTRIAL CATEGORY SALES 2015-2022e



Source: Hemp Business Journal *estimates ($ mil., consumer sales)*

composites used in the automotive industry are currently estimated to be the largest industrial application; however, as U.S.-based processing and manufacturing capabilities grow, other applications — including oil well linings, insulation, fiberglass, biofuels, bioplastics, and animal bedding and feed — are expected to make meaningful contributions to the market.

Industrial applications are estimated to have contributed $177 million to the 2018 market, which is projected to expand at an average annual growth rate of 30% through 2022.

> **“Stalks are still really something that no one (except us) is really using. The market price is about $100/ton and farmers can get about 2 to 4 tons per acre.”**
>
> JOHN LUPIEN, BASTCORE

U.S. HEMP: 2022 ESTIMATED SALES BY INDUSTRIAL PRODUCT TYPE

Source: Hemp Business Journal *estimates ($ mil., consumer sales)*

Bastcore, a Colorado-based industrial processor, has focused on creating processing equipment that will allow them to sell hemp-processed materials into high-margin applications. After a couple of years of processing development and fine-tuning, the company now expects to be selling fibers for fine-count yarns used in the textile industry, a high-margin niche market that has been a focus from the start. The company has also developed a micronized powder from hemp wood fractions, which they are preparing to field test for an oil-drilling product. They are also exploring possible bioplastic and synthetic fiber applications for the powdered product.

PEOPLE. PLANT. AND GROWING PROFITS

Consumer product and industrial companies are focused on sustainability and the long-term growth potential of the hemp industry rather than on maximizing short-term profits. Rawganique, for example, is focused on producing textiles that are free of chemicals, are not produced in sweat shops, and are organic in order to meet the needs of customers that have chemical sensitivities or are looking for more environmentally friendly products. By controlling the product from seed to shelf, they are able to serve a niche market. As Rawganique's Aiden told New Frontier Data, "It is almost a public service, because no one else would want to do it that way. It is way too high-cost, and not efficient and not profitable enough. That is what protects us. All of the big companies may want to consider moving into this space, but look at it as unattractive because the margins are not high enough and the volume is too small."

Another industrial hemp-based company, Old Dominion, leads the U.S. in hemp-made animal bedding products. It continues to develop its supply chain, and anticipates that the passage of the 2018 Farm Bill will drive greater production and higher margins. Marty Phipps, Old Dominion's owner, said "It has taken so much work to fine-tune our importing costs and how we ship hemp bedding, how we pack it, how we receive it. All of the systems had to be put into place to make it a functioning business. At the same time, our margins are very small. The market is getting ready to hit the U.S., and establishing a different product into the market is going to be beneficial to us. Once hemp is grown domestically, it will greatly help our costs."

> **"We are working really hard to reduce cost. We are importing right now, and we are really happy with our relationship with our European supplier. But when I started this activism for our state (Virginia) — that was five or six years ago — the goal has always been to bring this crop to the states and to grow here, hopefully, in my own backyard. But (Virginia) isn't as open with some of the laws as the other states."**
>
> MARTY PHIPPS, FOUNDER AND CEO, OLD DOMINION

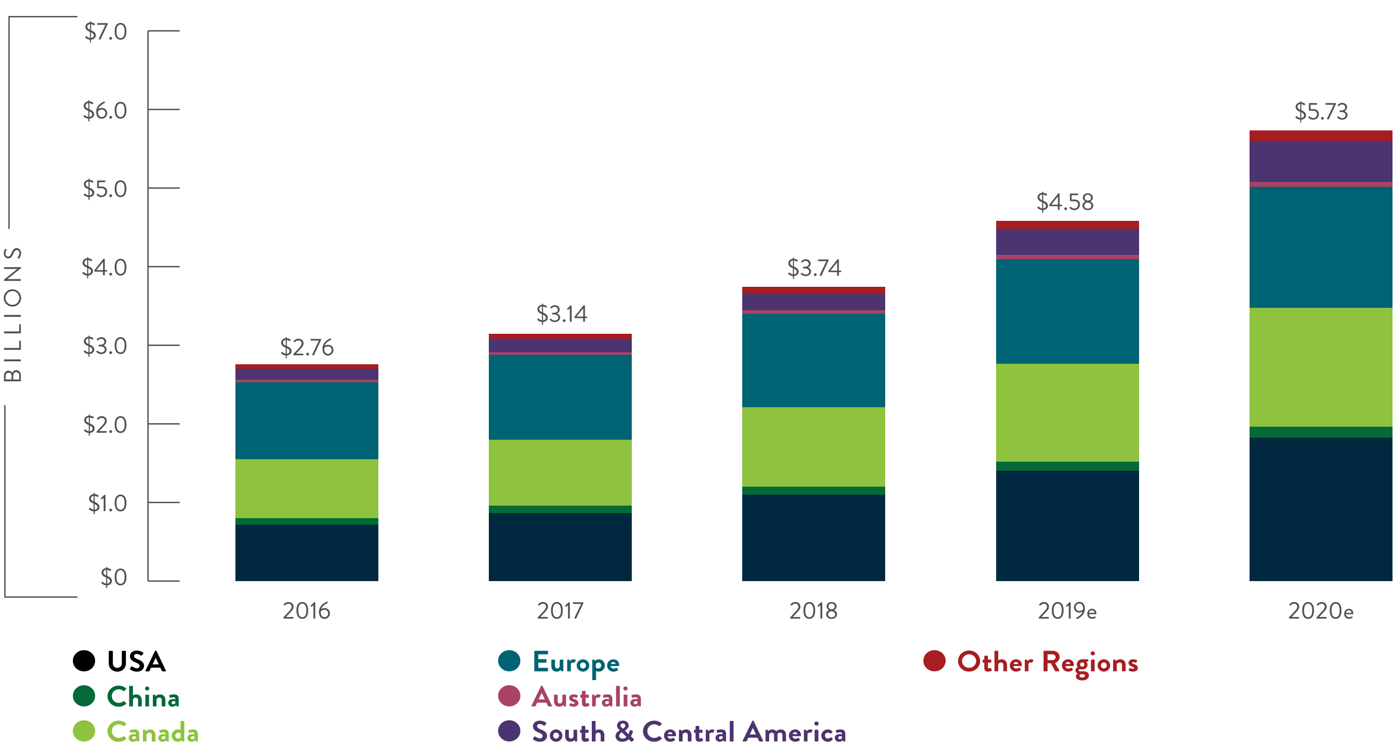
THE GLOBAL HEMP MARKET

THE GLOBAL HEMP MARKET is going through a period of rapid expansion and dynamic change. What has been true for the industry to date may not be true tomorrow. Just as the U.S. Congress legalized hemp in 2018, countries across the globe are following suit.

While Europe, China, and Canada are the current primary sources of hemp, that dynamic is quickly changing as new cultivators, manufacturers, and processors build operations in many new locations.

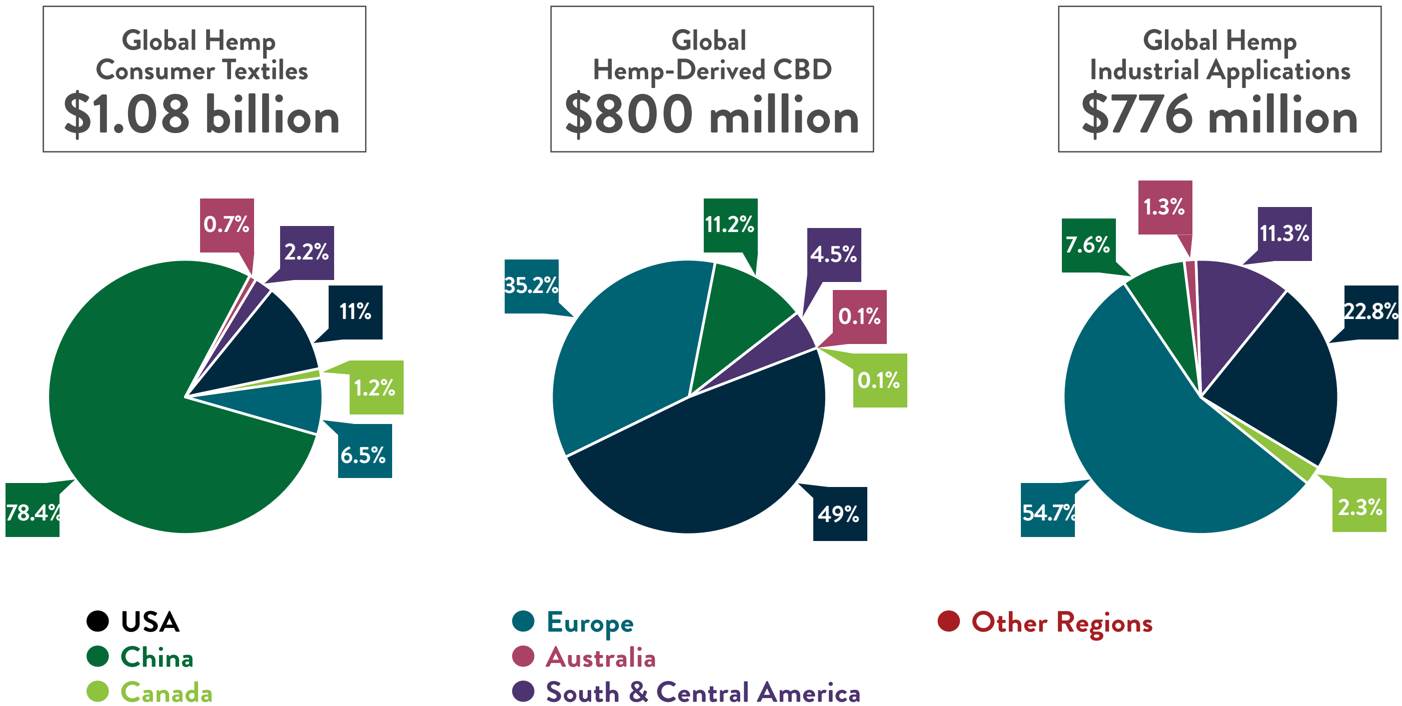
HBJ estimates that global hemp sales reached $3.74 billion in 2018, and those sales are expected to reach $5.73 billion by 2020. It is a nascent market compared to many other global industries, but individuals and corporations across the globe are excited about the fast future potential. The U.S. led global markets across hemp-derived CBD, food, supplement and personal care products. China led global markets in textiles with $854 million in sales. Europe led the global market with $424 million in industrial product sales.

GLOBAL HEMP SALES 2016-2020e



Source: Hemp Business Journal *estimates ($ bil., consumer sales)*

GLOBAL MARKET SHARE & SALES BY HEMP PRODUCT CATEGORY IN 2018



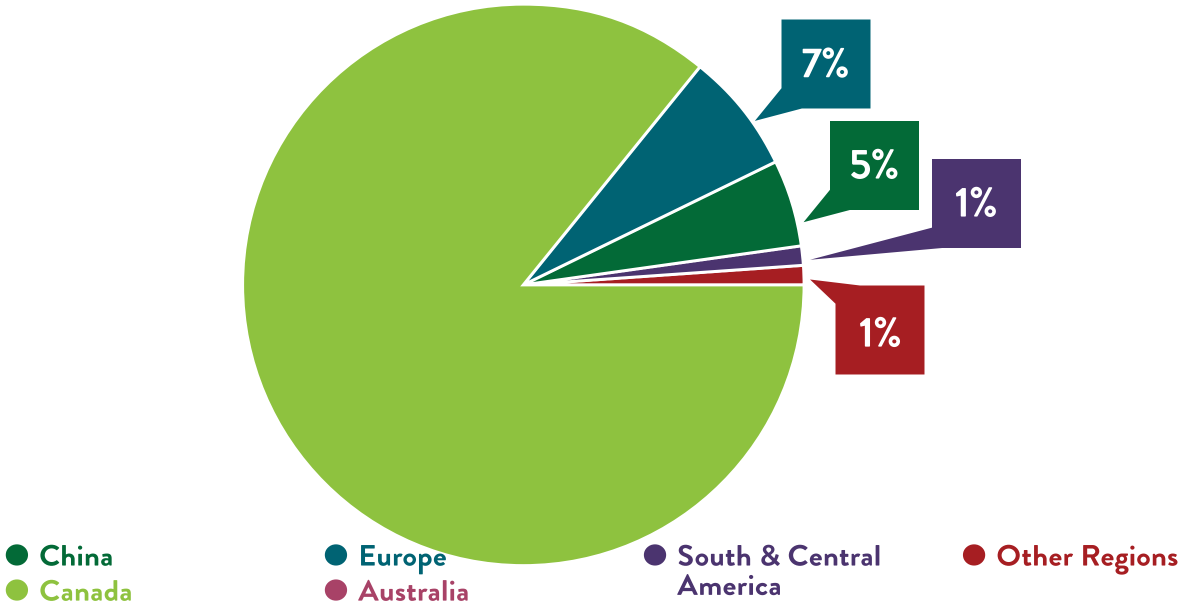
Source: Hemp Business Journal *estimates ($mil, consumer sales)*

Currently, the U.S. is a major user of the world's hemp supply. The U.S. imported $68 million in hemp products in 2017 (many being raw materials or yarns, and products not flagged as primarily hemp were not tracked). In contrast, U.S. hemp exports are only about 5% of the size of imports, with most exported products going to Europe.

Historically, outside of the U.S., every global region has developed unique hemp markets. Top 2017 cultivator Canada has been focused on food-based hemp, and exports most of its hemp crop. China focused on hemp textiles thanks to cheap labor and business-friendly regulations. Europe, the third-largest market, often produces nearly as much as Canada, but primarily uses its crop domestically, and even imports additional hemp from places like Canada and China, with consumers and corporations using hemp for a wide array of applications, especially industrial uses.

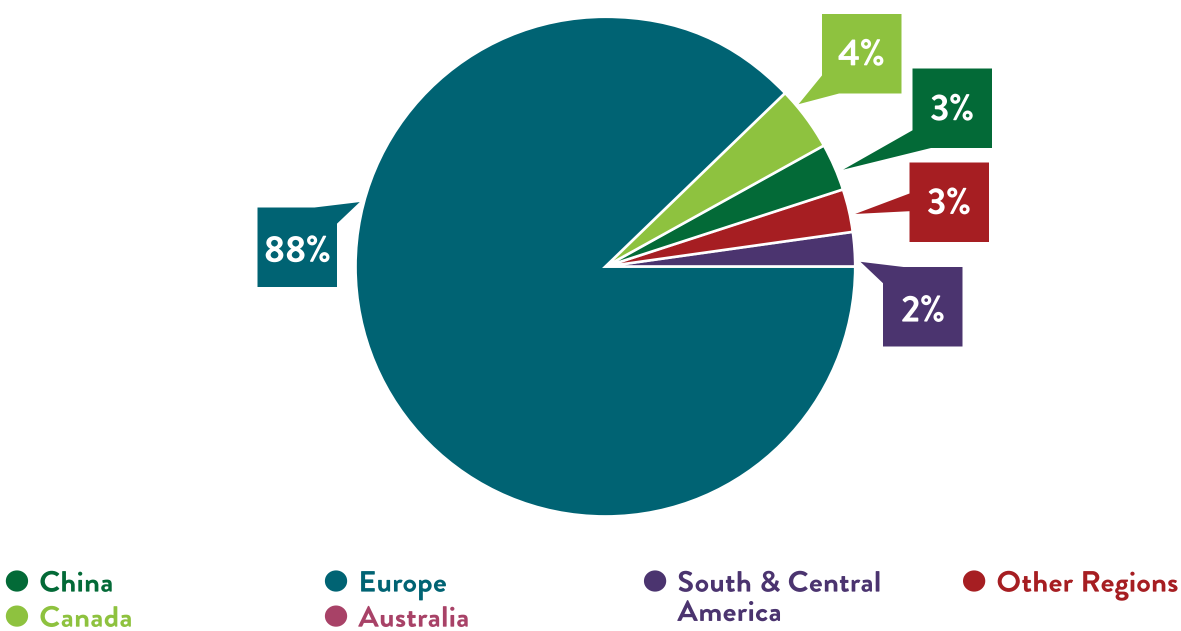
Due to changing hemp cultivation, processing, and use laws, along with the recent global interest in CBD, the global hemp market is in a major state of flux. Canada allowed CBD manufacturing as a part of its 2018 Cannabis Act, which legalized cannabis federally. Europe is expanding its use of hemp beyond industrial uses. China is allowing foreign companies to start manufacturing CBD products inside of Chinese borders. Australia has begun licensing cultivation of hemp for foods, as well as legalizing medical cannabis. South American countries are in the process of transitioning from a large illegal cannabis market, to allowing legal psychoactive cannabis and non-psychoactive hemp cultivation and sales. And a growing

U.S. HEMP EXPORTS BY TARGET REGION IN 2017



Source: U.S. Census Bureau Economic Indicators Division USA Trade Online, U.S. Import & Export Merchandise trade statistics ($US Customs Value). Hemp product codes 1207990120, 1207990220, 1207990320, 15150904010, 1515908010, 2306900130, 5302, 530820, 5311004010

U.S. IMPORTS BY SOURCE REGION IN 2017



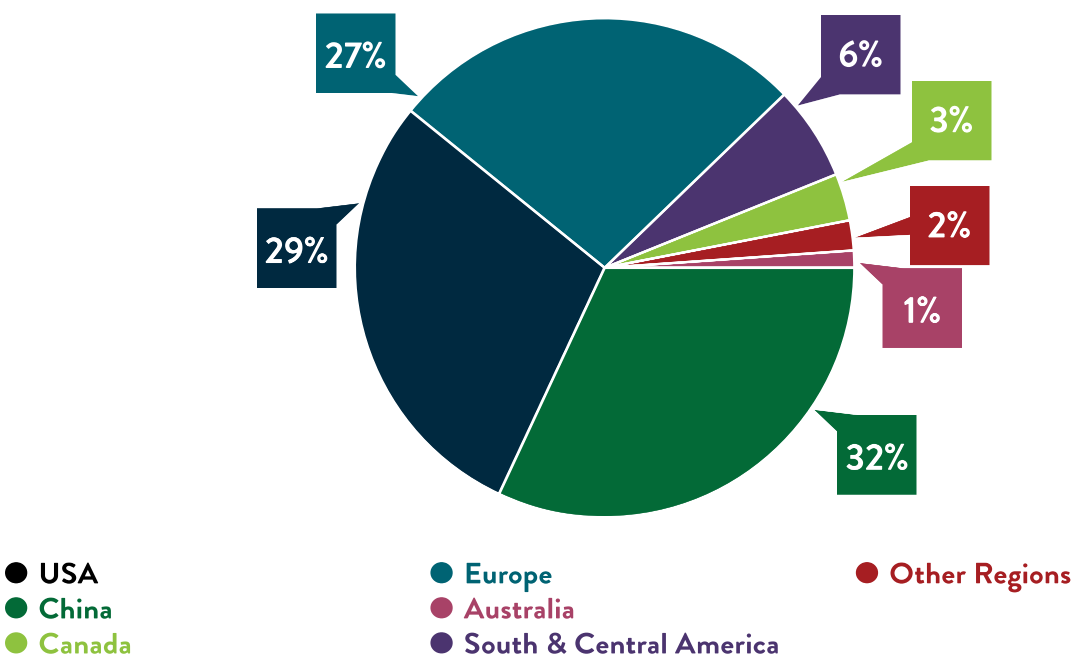
Source: U.S. Census Bureau Economic Indicators Division USA Trade Online, U.S. Import & Export Merchandise trade statistics ($US Customs Value). Hemp product codes 5302, 530820

number of African countries are weighing hemp cultivation. The pace of adoption is accelerating as governments and consumers alike embrace the plant's diverse applications.

In this report, New Frontier Data presents the world's first estimate of consumer sales of hemp products globally. Such are consumer sales estimates for finished products only, and do not include raw material sales, distributor sales, or other steps in the value chain. The country or regional estimates provided herein are also solely for domestic consumer sales, and do not include sales of products manufactured within a country but exported to another region for final use. For instance, while China produces most of the world's hemp textiles, the sales estimate for hemp textiles in China are only for those products used by Chinese consumers, as opposed to Chinese textiles that are sold in the U.S., for instance, and then counted as part of U.S. hemp product sales.

Unlike the U.S. where some sales of hemp products are tracked through point-of-sales data, there is currently available little to no data on finished hemp product sales globally. The estimates included herein are based on an analysis of global cultivation data, import and export data for the U.S. and Canada, country and regional population and GDP data, and valued insights from the experts at companies working in the hemp industry across the globe. New Frontier Data will continue to refine these estimates as more reliable and comprehensive sales information becomes available.

$3.7 BILLION GLOBAL HEMP-BASED PRODUCT SALES BY REGION IN 2018



Source: Hemp Business Journal *estimates ($ bil., consumer sales)*

AUSTRALIA

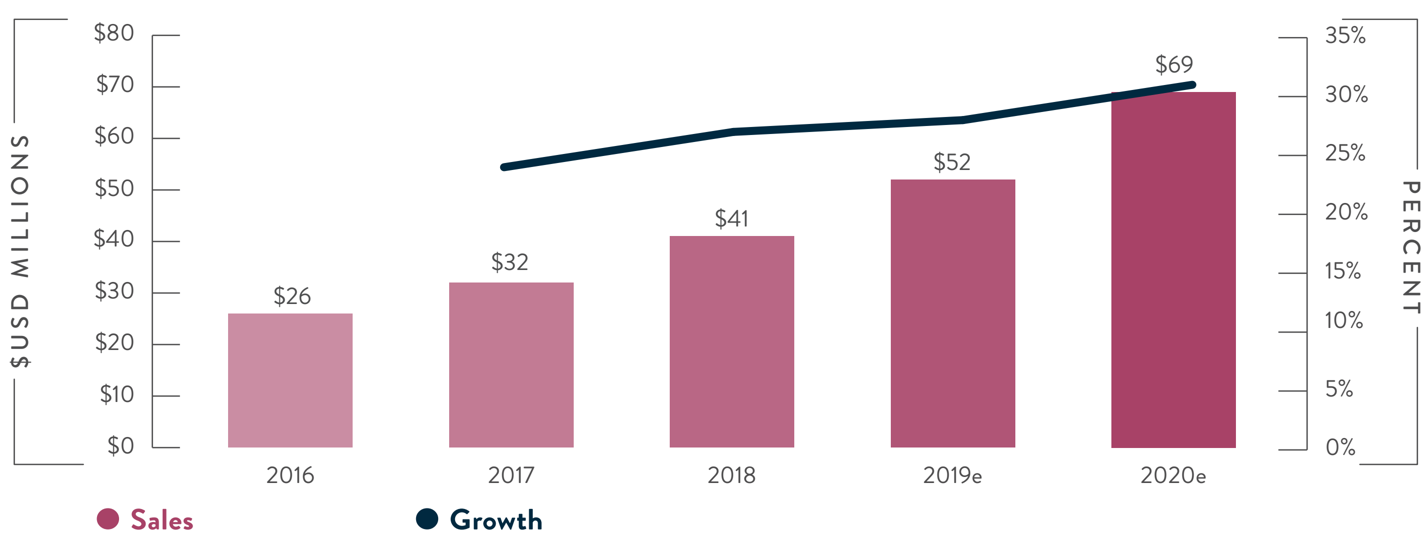
Australia's hemp market remains nascent: As a country of 25 million people, remote from other big hemp markets, and with newly changing hemp laws, Australia's hemp industry is currently focused more on building infrastructure than producing significant sales relative to other global regions.

Legal hemp food sales in Australia only began in November 2017. Prior to legislative change, hemp foods were available in Australia but were marked as "not for human consumption." That did not keep diehards from purchasing such products, but the labeling kept hemp from going mainstream. Some of Australia's hemp seeds came from Canada, with Australia accounting for well less than 1% of Canada's 2018 hemp seed exports. Now local and international hemp food brands are slowly entering the market and educating Australian consumers.

"Consumers generally are being educated in the benefits of hemp as a source of omega fatty acids and protein. As hemp food products (seeds, oil, protein and flour) and food products containing hemp (cookies, tea, honey, drinks, etc.) hit supermarkets, health food, and specialty food retailer shelves, hemp foods will become more mainstream," says Linda McLeod, managing director for Elixinol Global Limited in Sydney, Australia.

Because Australia does not have a strong hemp cultivation history compared to a country like Canada, it has been a slower start for farmers entering the industry. Australian farmers themselves are being educated in the potential of hemp as an agricultural crop. What are the best genetics? Which seeds are best suited for the different climatic conditions within Australia? "That is something that requires time and experimentation," notes McLeod. Cultivators over the last couple of years have been working through a trial-and-error process

AUSTRALIAN HEMP-BASED PRODUCT SALES 2016-2022e

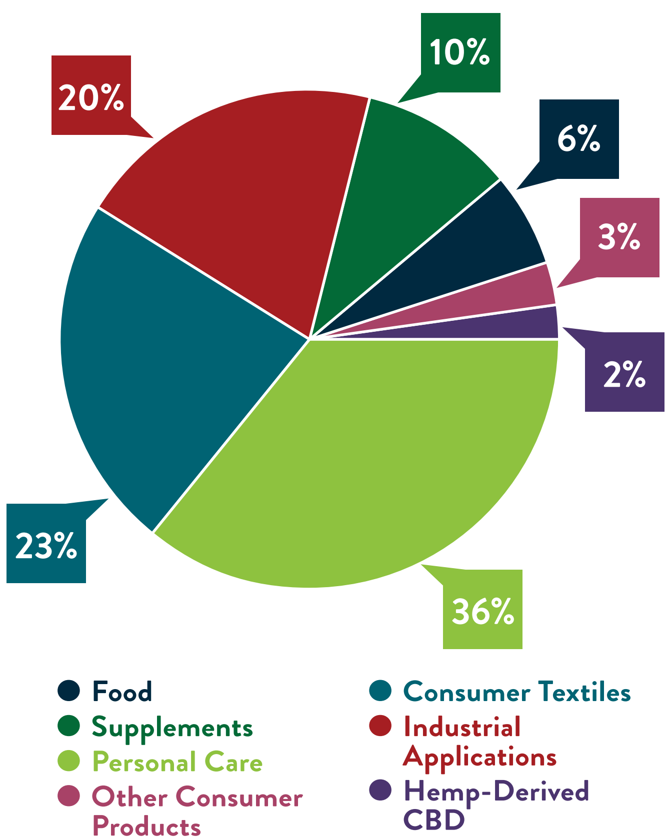


Source: Hemp Business Journal *estimates ($ mil., consumer sales)*

to see which hemp seed varieties are best suited to the varying climatic conditions in Australia.

Beyond the hemp industry, Australia legalized medical cannabis in October 2016 and legislated a licensing framework for the cultivation, production, manufacture, and delivery of medical cannabis products. The program is still in its infancy as both doctors and patients become educated in the potential therapeutic benefits of cannabis. However, the changes in law have attracted significant interest from companies that want to enter the market, and patients seeking therapeutic alternatives to pharmaceuticals. However, the new system provides little benefit for hemp farmers, as they are only allowed to grow and sell seeds.

$41 MILLION AUSTRALIAN HEMP-BASED SALES BY CATEGORY IN 2018



Source: Hemp Business Journal *estimates ($ mil., consumer sales)*

Australian medical cannabis legislation regulates cannabis products with either a Schedule 4 or Schedule 8 classification. To meet Schedule 4 guidelines, cannabidiol (CBD) must comprise at least 98% of the total cannabinoid content of the product. Schedule 8 products contain THC, and less than 98% CBD. While Schedule 4 products might seem like the perfect category for Australian hemp producers to target, that is not the case. Australian cultivators must hold a medical cannabis license to participate in the medical cannabis sector, including any CBD products.

"Under the current legislation you are only allowed to grow hemp for seeds, which are then used in food, whether that is for hemp seeds, oil, flour, or protein – really as a functional food for the omega fatty acids," explained McLeod.

Elixinol Global Ltd.'s Australian-based medical cannabis division is awaiting licensing to enable the cultivation, production, and manufacture of both CBD and THC products for the prescription-only medical market. As Elixinol and other companies wait to receive production licenses, Australian consumers are becoming more familiar with cannabis, CBD, and hemp products, and demand is steadily building.

While the restrictive rules and relatively small size of its population mean that domestic demand is unlikely to make Australia a global hemp powerhouse, Australia is beginning to build the infrastructure to support a healthy domestic hemp industry from seed to shelf, and to become an important player in the global hemp food economy.

CANADA

Canada has become the leading cultivator of hemp, but the achievement was not without its share of growing pains as the industry developed. Overly enthusiastic cultivators created a large oversupply in 1999 as the market was just emerging, and again in 2006, leading to several years of low production. Production has been on a steadier upward trend since 2011, but the large spike in 2017 has industry experts expecting lower commodity prices and a smaller 2018 crop. At the time of this report's publication, Health Canada had not published cultivation data for 2018.

Canada produces primarily hemp seed and oil for use in foods, with much of what is produced being exported primarily to the U.S. Through 2015, the U.S. was the destination for about 90% of the value of exported Canadian hemp products (based on values in USD$), according to government of Canada data. In 2016 that percentage dropped dramatically, to about 50% as South Korea purchased close to 40% of Canada's export crop. The value of Canadian hemp exports decreased by nearly half in 2017, with South Korea accounting for only 13% of those sales, and the U.S. for 77%. The wild market swing was driven by a dramatic fall in demand in South Korea (their hemp fad ended), along with continued growth in the U.S. market. Europe's increasing interest in hemp seeds has left that region with a shortage which they have begun filling somewhat with Canadian product (along with China), accounting for about 9% of the 2017 Canadian export market.

CANADIAN HEMP SALES 2016-2022e

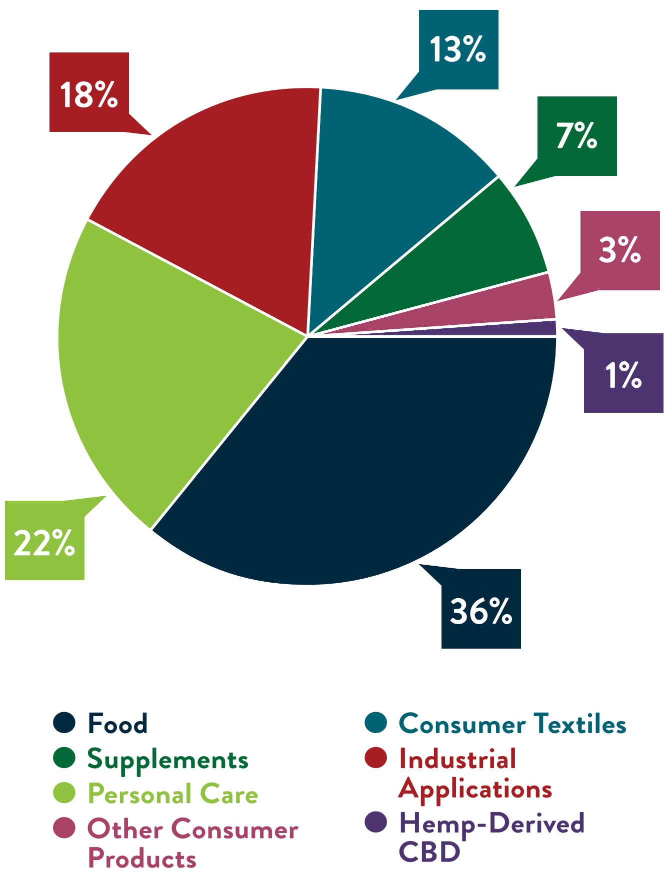
Source: Hemp Business Journal *estimates ($ mil., consumer sales)*

In 2017, Canada exported 77% of the hemp grown in Canada to the U.S., and meanwhile imported 17% of the hemp it consumed from the U.S.

South and Central America combined to serve as the largest import market for Canada.

In general, the Canadian consumer's interest in healthy food products is similar to that of the U.S. consumer, but Canadians are much more familiar with hemp. "It is less of a novelty in Canada. Household penetration is much stronger in Canada than it is in the U.S. From that perspective, we have less of an education and awareness campaign required for Canadian consumers. Our Canadian consumers are looking for innovation, looking for more ways to use hemp," say Bill Chiasson, chairman and CEO of Manitoba Harvest Hemp Foods. Manitoba Harvest has found that when it introduces new products, Canadian consumers have a better understanding of the health value of the products and tend to adopt them more quickly than their friends to the south, at least for now.

$100 MILLION CANADIAN HEMP MARKET BY PRODUCT IN 2017



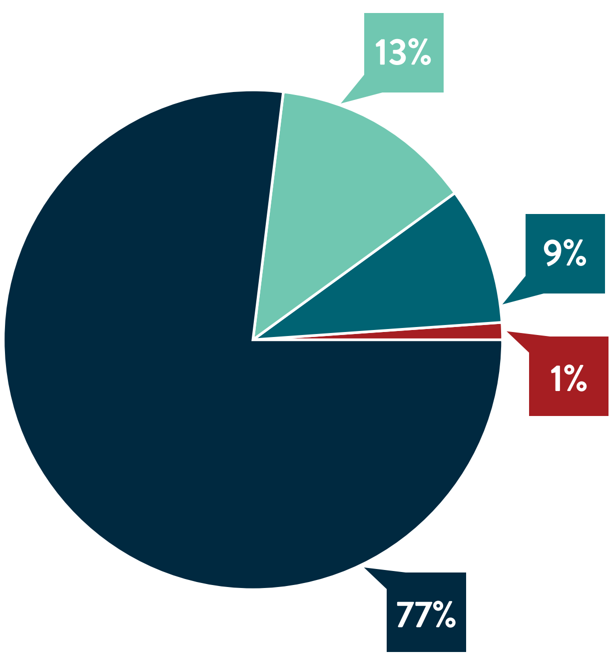
Source: Hemp Business Journal *estimates ($ mil., consumer sales)*

Going beyond Canada's mainstay hemp seed for foods market, industry players are excited about new legislation in the Cannabis Act that will allow the country's hemp producers to compete in more diverse markets – with a primary focus on CBD. On Aug. 10, 2018, Health Canada approved the use of the whole hemp plant with sales authorized beginning on October 17 with implementation of the Cannabis Act.

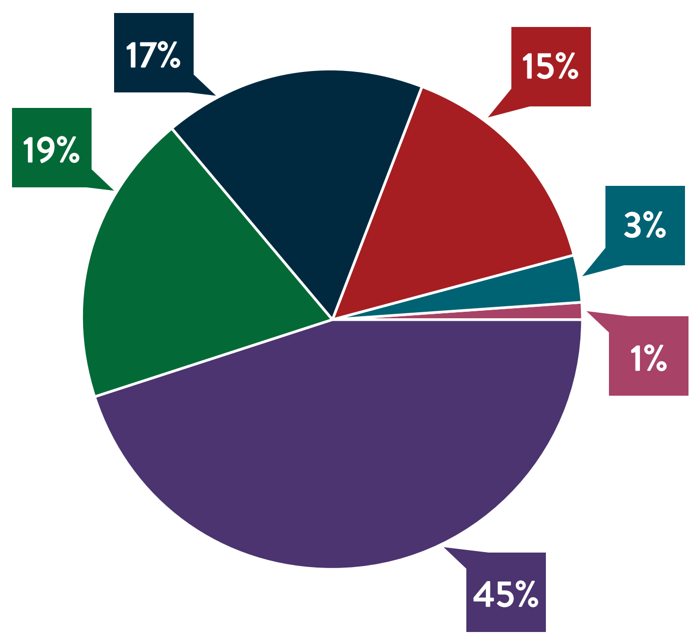
Under the new regulations, Canadian cannabis licensed producers (LPs) are able to purchase flowers and leaves from hemp producers, extract CBD, and develop products to sell into the newly created adult-use market. In anticipation of the regulatory changes, there has been a boom in M&A activity in Canada, as LPs cut deals to create alliances with hemp producers to establish efficiencies and reduce costs in their supply chains. For instance, Canopy Growth Corp. purchased Mettrum Health Corp. (a hemp cultivator and player in the medical cannabis and hemp functional food categories), while also acquiring Green Hemp Industries (a Saskatchewan hemp farm operator) and ebbu (a Colorado research and development company).

One risk facing the Canadian hemp industry is the likelihood that export demand will fall as other regions around the globe, especially the U.S., ramp up their own production. Fortunately, the rapid growth in overall consumer demand as well as strong cultivator/manufacturer relationships should help offset the increased competition, and enable Canadian producers to maintain their market-leading position in the near term. “It comes back to 20 years of building the relationships; you get to know producers very well,” says Chiasson. Canadian hemp growers have built valued relationships with their customers, and will be there to continue to serve them even as the industry expansion provides plenty of space for new cultivator entrants.

CANADIAN HEMP EXPORTS BY REGION IN 2017



CANADIAN HEMP IMPORTS BY REGION IN 2017



● USA ● China ● Canada ● Europe ● Australia ● South Korea ● South & Central America ● Other Regions

Source: Hemp Business Journal *estimates ($ mil., consumer sales)*

EUROPE

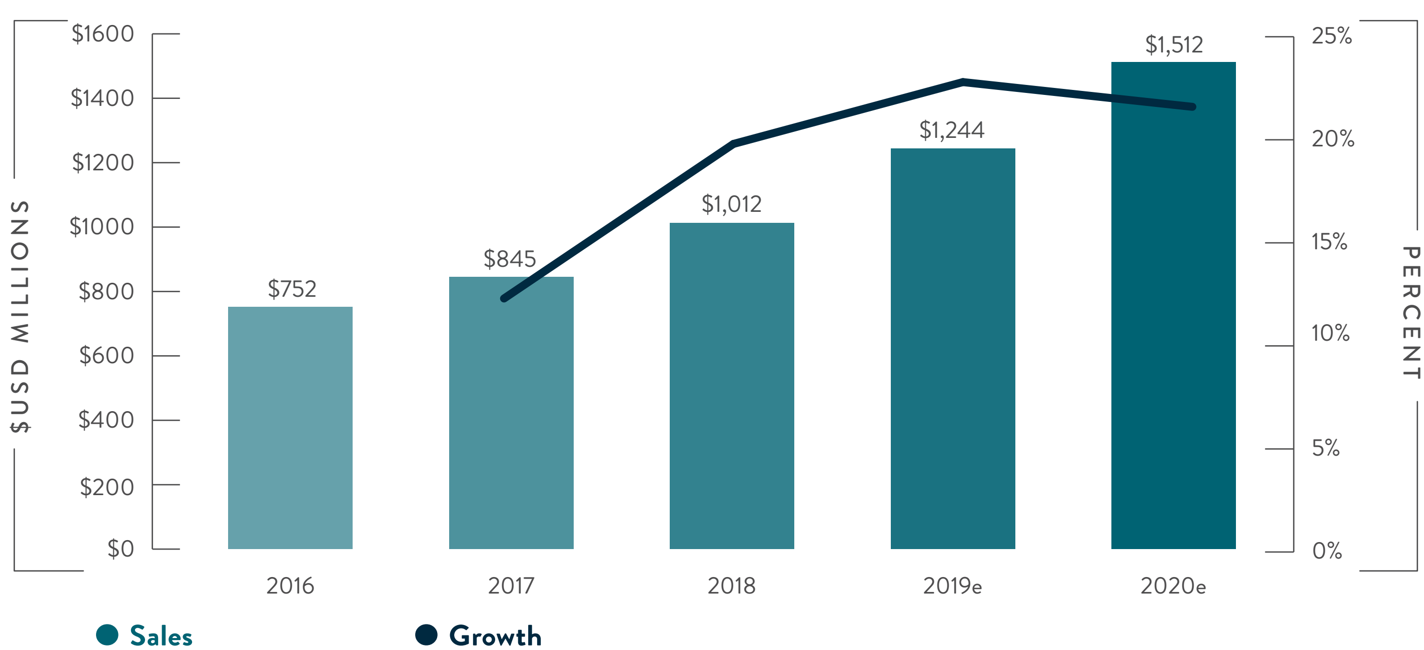
Europe is estimated to produce close to 1/4 of the world's hemp crop. France alone accounted for 40% of the European acreage, with at least 20 other countries contributing to the European Union's total.

As has happened in Canada, European cultivation has seen ups and downs as the raw material market works to adjust supply to meet finished good demand. After a couple of decades of cultivation averaging out to around 15,000 hectares annually, European hemp cultivation has been on a major upswing for the last several years, as producers and consumers become more excited about new usage opportunities.

Unlike the Canadian market that has focused on hemp seed applications, Europe has developed a strong processing infrastructure and a finished goods industry based on using hemp fibers in industrial applications. Paper and pulp (for cigarettes and specialty paper applications), along with biocomposites (used in the automotive industry, and for insulation materials) are the most established uses in Europe for the fibers of hemp plants. Hemp shivs, a byproduct of the fiber extraction process, also have a long-established European commercial use, primarily as animal bedding, but also increasingly for use in the construction industry, especially for insulation.

In the last several years, along with the tremendous increase in overall cultivation, the European

EUROPEAN HEMP SALES 2016-2022e



Source: Hemp Business Journal *estimates ($ mil., consumer sales)*

market has experienced a great surge in its use of seeds and flowers, and the associated applications of those hemp components. According to EIHA, the EU produced 11,500 metric tons of hemp seeds in 2015 (the last year for which data is available), and imported another 10,000 metric tons, primarily from China. While the majority of hemp seeds a decade ago were used for animal feed, especially for birds and fish, EIHA now estimates that 60% of the crop is used for human food, with only 40% of it for animal feed. That shift is expected to continue as Europeans become more aware of the benefits of hemp and its omega fatty acid profile. The EU has also seen a major increase in the last four years in the harvesting of hemp flowers and leaves for medical and food applications (primarily around CBD).

CBD sales are also rapidly increasing in Europe; however, the market continues to struggle with inconsistent regulations. Antonin Cohen of Meet Harmony, whose company extracts CBD from hemp grown in the Czech Republic, explains that "there are no specific regulations around CBD products yet. In most European countries, CBD products should be THC-free and made from EU-registered industrial hemp strains." Unfortunately, complications arise quickly as most industrial hemp is being bred with less than 0.3% THC levels, but is not THC-free. Cohen is involved with the launching of TradeACTIVE, the first CBD vaping trade association in Europe, to support the development of legal guidelines for CBD e-liquids.

“While the majority of hemp seeds a decade ago were used for animal feed, EIHA now estimates that 60% of the crop is used for human food.”

Elixinol, which has been selling into Europe since 2014, is one of many companies having to deal with the difficulties of navigating the European CBD market as they ramp up their presences.

"It becomes very tricky to navigate from one country to another and try to find that one point of commonality so that you know how to proceed from a marketing or processing standpoint," says Elixinol's General Manager Gabriel Ettenson. "There are similarities to the U.S. from a regulatory standpoint, but there is still a little bit of confusion around prior regulations and how extracts fit into those regulations. The question of the World Health Organization (WHO)'s position has also been a variable in Europe, but their recent statement of position is very encouraging." WHO's recommendation to deschedule CBD has the potential to help spur further clarity regarding CBD in the European market.

CBD sales are flourishing in the UK and Germany, with France, Italy, and many other countries also presenting growing opportunities. Switzerland is unique in the region because it allows up to 1% THC concentration for hemp cultivation and in final products.

CBD products are enjoying wide distribution in Europe – from tobacco shops and vape stores, to traditional supplement stores like UK-based Holland and Barrett. Such products are also in convenience stores, supermarkets, and online retailers, including Amazon. European-based manufacturers may focus more on retail presences, while foreign companies like Elixinol are relying heavily on trading online.

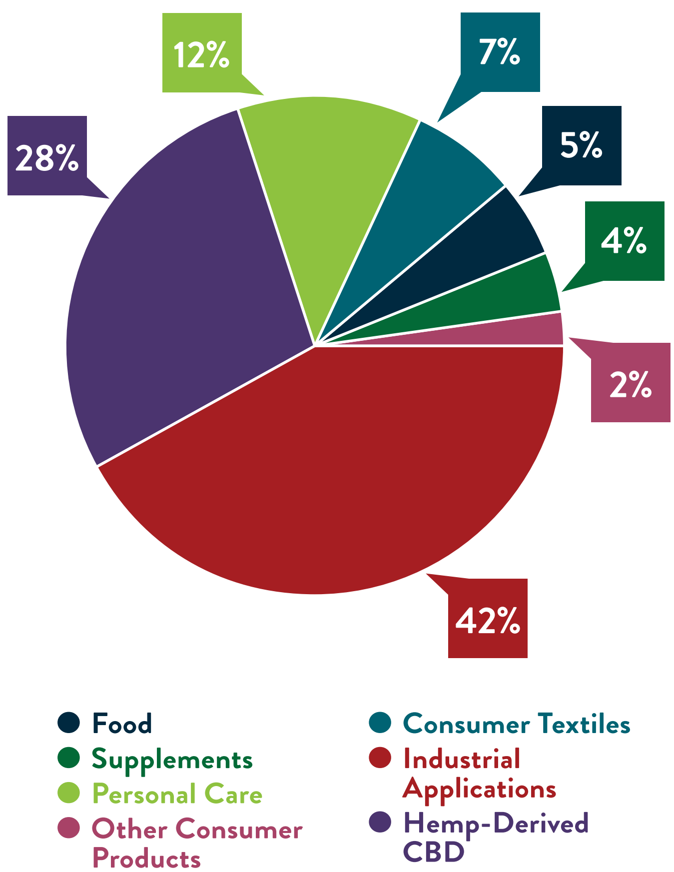
Hemp food regulations are also of concern for the European market. In Germany, food products must have less than 5 parts per million of THC; while many other countries have no specific guidelines of their own, they rely on the German standard by default.. The issue can be made worse by varying test methods used in different countries: Some tests count THC and THC-A (which is non-psychoactive) as part of the threshold, while others test just THC, so the same product might pass or fail the THC threshold test depending on testing locale.

Hana Gabrielová, CEO of Hempoint in the Czech Republic, has been frustrated by existing European regulations regarding hemp. Her company had a tea shipment headed to the UK that was stopped at the French border because it tested positive for slight traces of THC. Excited about hemp and its sustainable possibilities, yet frustrated by inconsistent and unclear European hemp regulations, Gabrielová is hoping for change.

"We need the hemp and medical/recreational cannabis industries to step up to the plate and fund organizations like FAAAT (For Alternative Approaches to Addiction, Think & do tank) that are working at the international level to change the scheduling of cannabis. The UN 1961 Single Convention which made cannabis a schedule I narcotic is under review for the first time in 60 years. This is truly a historic moment," says Gabrielová. "We need to educate politicians and the public or we will never get anything good done."

Mark Reinders, CEO of HempFlax, feels that Brexit is making it even more difficult to create regulatory harmony among the various countries in the European Union. "Europe is difficult at the moment since the UK left. It is chaos. They are very afraid to impose more EU-wide regulations on countries.

$1.01 BILLION EUROPEAN HEMP MARKET BY PRODUCT IN 2017



Source: Hemp Business Journal *estimates ($ mil., consumer sales)*

There is more tendency of decentralization rather than centralization because of Brexit," says Reinders, who also serves as the current president of EIHA.

Unfortunately, country-by-country regulations can also hamper uniformity about which parts of the hemp plant may be used. In Germany and Romania, flowers and leaves can be harvested, but in France and the Netherlands, only the fibers and seeds can be used. In some countries, extracts are illegal whether from hemp or marijuana, but in others they are allowed as long as THC levels are low enough.

As a large company, HempFlax has found a work-around. "Our supply chain from field to customer is crossing at least four countries. You look for those countries where each process step is legal, and then you do the next process step in another country. It is a very complicated situation, and it is very inefficient."

The EIHA has proposed guidelines for food products recommending standardizing to 10 parts per million to match the Canadian market.

Europe's hemp market, like most global markets, is working through some serious growing pains, but while doing so it is also quickly building a strong, diverse hemp industry for the future.

CHINA

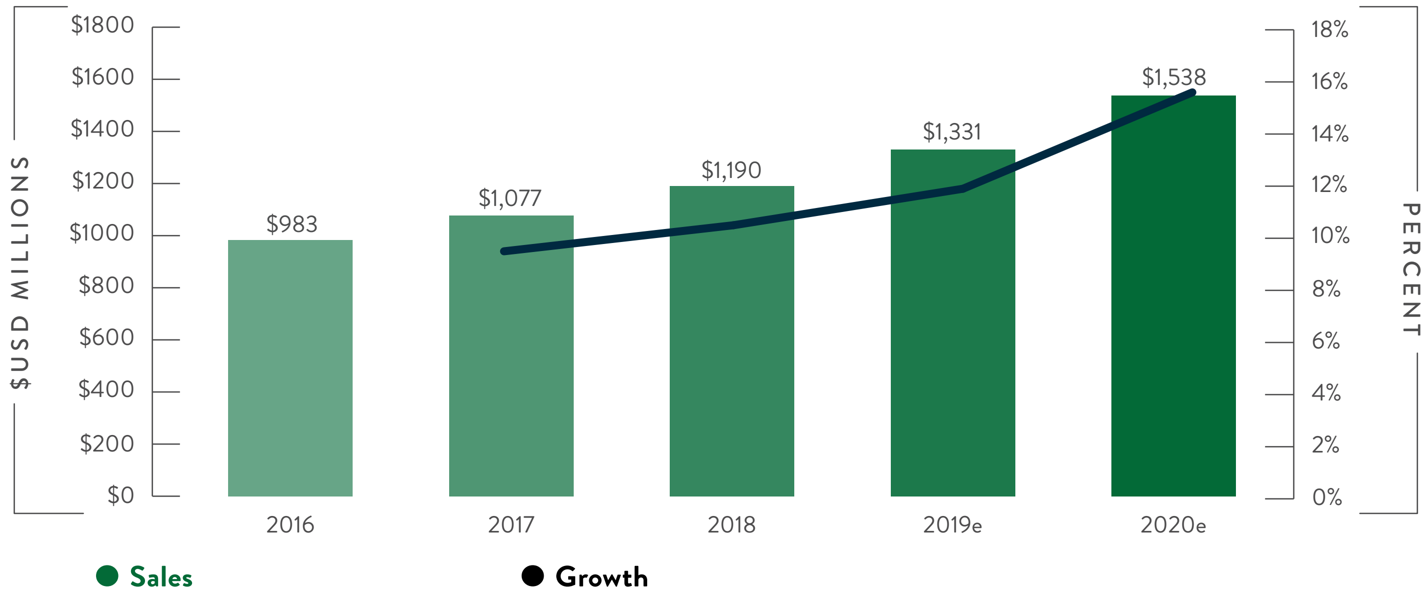
China's hemp sector has developed around textiles. China's large, inexpensive labor force has allowed the country to succeed in an industry that is very labor-intensive.

China's lax environmental policy enforcement has also been key to the industry's growth. "In China, parts of the process are not the most ecological, and I think that is going to come to light. It cannot be duplicated and done here [in the U.S.] like that. You cannot wet process a lot, you cannot just bundle stocks and dip them into the river. They do a lot of combing of the fiber that is just manual labor. It is not like we can just come up with the capital and do what the Chinese are doing. We have to reinvent the wheel here," said Matt McClain from hemp apparel company Recreator.

With well-established infrastructure, it is unlikely China will lose its position as the global hemp textile leader anytime soon. While other regions are working to build hemp textile production facilities, they are not yet competitive with China, and most regions will struggle to compete against its low-cost production. As McClain added, "The finished fiber we are getting [from the U.S.] is about \$8/lb. To be competitive in the global fiber market, they are going to have to bring hemp down to about \$2.25/lb., which is closer to a really high-grade pima cotton or organic cotton. There is going to have to be an investment in infrastructure, probably \$25 million to \$30 million to do this vertically stateside at a scalable level."

A significant portion of Chinese hemp textiles stays in country – including for use in uniforms for the country's 2.5 million military personnel. While the largest market is textiles, China is joining in the CBD craze. There are,

CHINESE HEMP SALES 2016-2022e



Source: Hemp Business Journal *estimates ($mil, consumer sales)*

however, strict controls of the industry that keep foreign companies from selling CBD in the Chinese market. In 2015, Hempson Biotech was the first non-Chinese firm to receive a commercial license to grow hemp for CBD in China, but the company can only sell products via the export market. Before then, only the Chinese government, the army, and one university working with GW Pharmaceuticals were able to grow hemp for CBD. Today, four other companies hold similar licenses for export cultivation, indicating that the Chinese market is opening for more foreign cultivation investment as part of the broader easing of rules restricting foreign companies working in the country.

China is also becoming more open to foreign manufacturing. Hempson Biotech recently received permission to start producing finished goods in the country, including vape pens, topicals, and pet products, but such goods are for export only. Chinese-operated companies producing CBD products can sell within the Chinese market to meet the domestic demand.

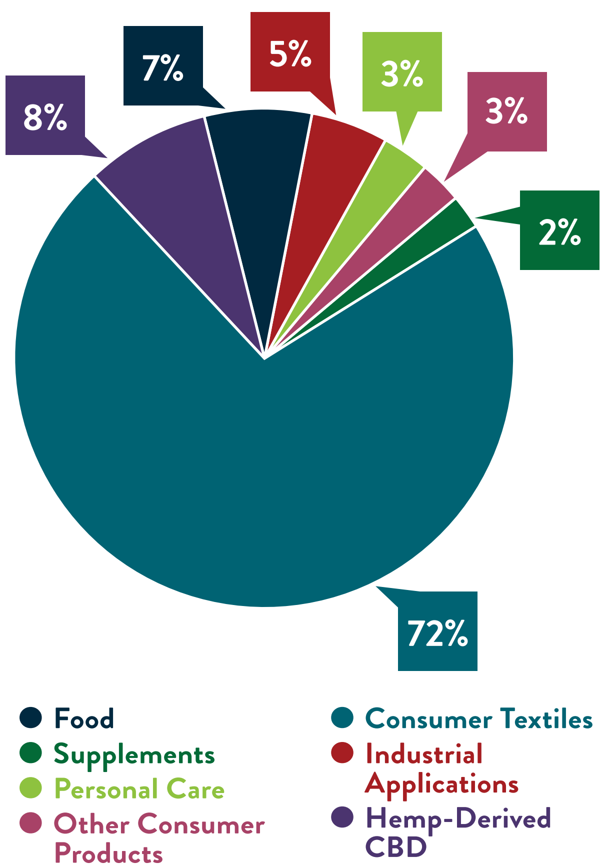
Murray is excited to be extracting from Chinese hemp grown in a part of the world where it has been cultivated for thousands of years. "I compare it to heirloom tomatoes: If you look at the genetic profile of our oil, it has things in it that you do not find in domestic oils or European or Canadian oils. I think it is because [Chinese hemp] has been growing in the same area for so long. It has developed cannabinoids and terpenes that you do not see in marijuana plants that were cross-bred, or hybrid, or in some of the strains you find domestically."

While the Chinese CBD market is closed to foreign business, other product opportunities are opening up. Hempson Biotech has found a secondary use for what would otherwise be hemp waste – creating hemp paper that is used in cigarettes. "It is a popular trend now to have half-tobacco and half-CBD, to actually put the paper in with the tobacco to make the cigarette, and also use the paper to wrap the cigarette," says Murray. The cigarettes are sold in

the domestic Chinese market positioned as a "healthier" cigarette, though such claims have not been proven.

China has a long history of cultivation and use of hemp traditional medicine (such as for healthy digestion), and Chinese consumers use hemp seed oil regularly. "They use every part of the plant, including the roots" says Murray. Because of such interest and use of the whole hemp plant, there is a large current and potential market for hemp products in China.

$1.2 BILLION CHINESE HEMP MARKET BY PRODUCTION 2018



Source: Hemp Business Journal *estimates ($ mil., consumer sales)*

SOUTH AND CENTRAL AMERICA

The combined hemp markets in South and Central America are evolving quickly. Countries that have long had a history of illegal cannabis cultivation are rapidly working to change laws and build infrastructure in order to create legal markets, and the future of hemp in those regions looks bright.

Unfortunately, entering the South and Central American markets is not without challenges. Similar to state and country variances seen across the U.S. and Europe, South American countries are each building their own approaches to regulating hemp. As Raul Elizalde, president Latin America for HempMeds told HBJ, "One of the problems is that we are changing the laws so fast that sometimes the lawmakers are making mistakes." And one of the most common mistakes he sees is the lack of differentiation between laws regarding hemp and marijuana.

In countries like Mexico, Brazil, Colombia, and Uruguay, cannabis rules are based on whether the plants have THC levels above or below 1%, rather than the hemp vs. marijuana distinction used in most other parts of the world. They also differ in that they define non-psychoactive cannabis (hemp) as having less than 1% THC, rather than the 0.3% THC threshold used in the U.S.

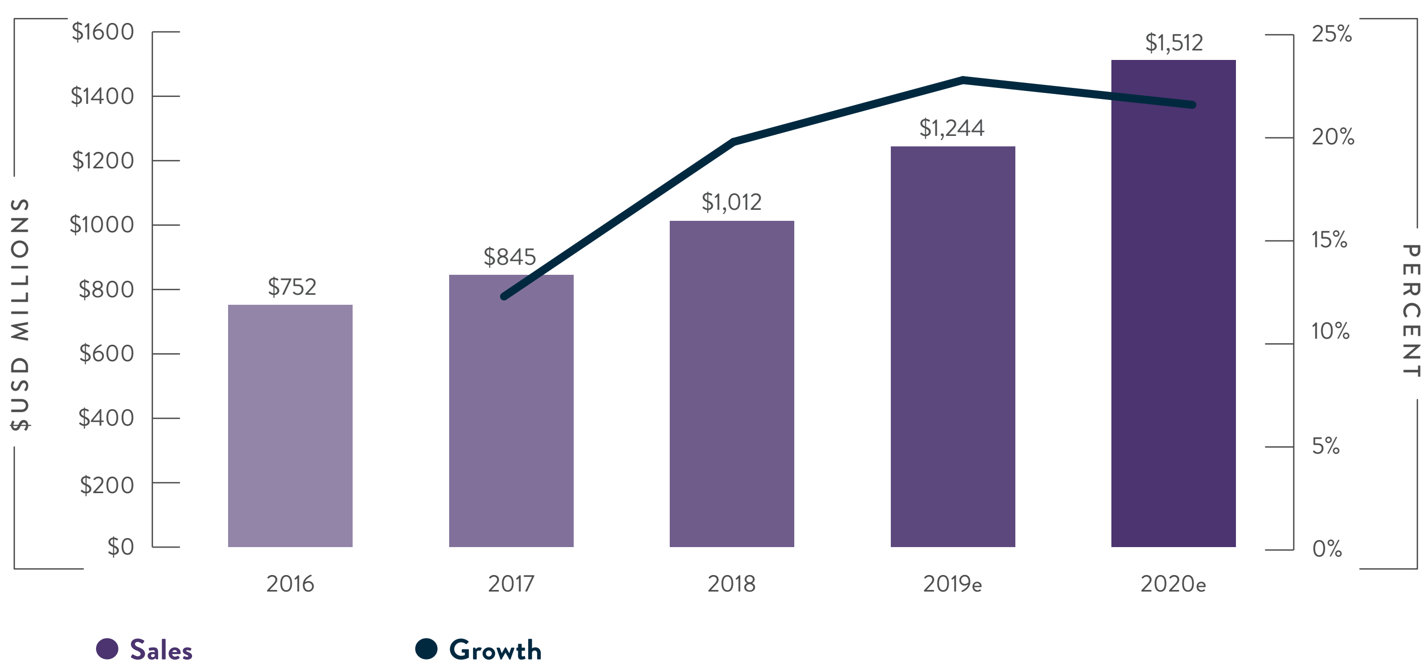
Medical Marijuana, Inc., though its HempMeds subsidiary, has been selling its hemp-based CBD products in the Brazilian market since 2014 via a doctor's prescription for children suffering from refractory epilepsy. According to Dr. Stuart Titus, the company's CEO, "The market in Brazil is very

well regulated by ANVISA (i.e., the National Health Surveillance Agency), Brazil's equivalent of the FDA. They regulate each individual shipment. It goes into customs and border control, where it is checked for the actual doctor prescription and the import permit for the individual patient."

Elixinol is also experiencing long-term success with its products in the Brazilian market. "Through multiple examples of positive responses through patients, people are starting to understand that these products have some efficacy," according to Ettenson.

The allowance of 1% THC is still relatively new. Mexico passed legislation in 2017 allowing for it rather than requiring products to be completely THC-free. Unfortunately, the new law allows for products to be sold, but does not allow for the legal cultivation of hemp or any type of cannabis, forcing businesses to import their products. Hemp imported from Europe or other regions remains the primary sourcing of it in South America, even as legalized domestic production is starting to ramp up. In Mexico, where cultivation is not allowed, its use is established in the auto industry, along with for other products like hemp foods and personal care, that are forced to rely on imported hemp. "That could be a huge market for Mexico that we are not exploiting right now," says Elizalde, clearly frustrated by the current prohibition to grow hemp inside of Mexican borders.

SOUTH & CENTRAL AMERICAN HEMP SALES 2016-2022e



Source: Hemp Business Journal *estimates ($ mil., consumer sales)*

Uruguay has established regulations for hemp cultivation and sales that will allow a domestic hemp market to begin to take root. The country has been growing hemp for a few years, and has some processing capabilities in place.

In 2018, Colombian farmers grew their first hemp products in regions sharing a long history of illegal cannabis cultivation. According to information released by the Colombian government in April 2018, 47 companies received licensing for psychoactive cultivation, 63 for non-psychoactive cultivation, and 12 for seed licenses.

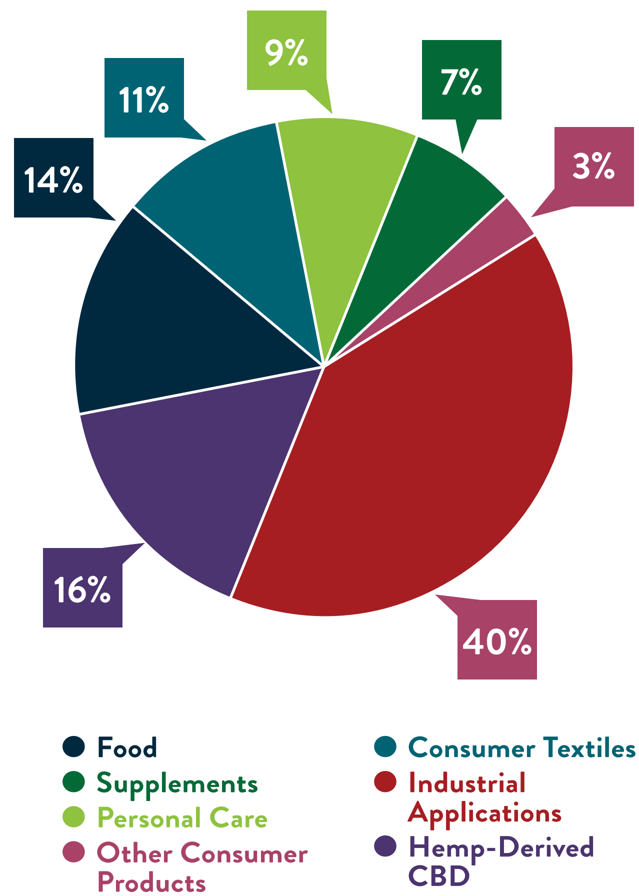
Titus explained that many companies are interested in partnering and investing in Colombian hemp crops because of the entourage effects of hemp containing certain cannabinoids, terpenoids, and flavonoids. "The interesting growing conditions and the soil in Colombia allow for many of these interesting terpenoids to flourish, and some people feel that the Colombian hemp and cannabis will command a premium price because it is a higher quality product," he said.

This first legal Colombian hemp crop is currently being grown as a test crop. Companies seeking to have a registered hemp variety for the first commercial applications needs to go through a characterization process where their specific seed variety is registered with ICA, Colombia's agricultural department.

"Anyone who is not able to complete this characterization process by the end of 2018 is out from production for roughly two years. So, everybody is racing to get their test varieties registered with the department to be approved as free from any pathogens or 'plagues' on their list," explained Greg Gershengorin, co-founder of QualCann, a licensed Colombia based grower, extractor, and exporter of medical cannabis products.

Gershengorin indicated that the ICA was overwhelmed by people seeking approval in the new industry. "That first crop will be used for approval or disapproval of those exact varieties for further commercialization of them. So, the uncertainty lies in whether those crops will be allowed to be sold, and

$173 MILLION SOUTH & CENTRAL AMERICA HEMP MARKET BY PRODUCT IN 2018



Source: Hemp Business Journal *estimates ($ mil., consumer sales)*

furthermore what size companies should make those test crops based on the risk of total loss if disapproved," added Gershengorin.

There was widespread uncertainty in Colombia in 2018, between new approvals pending and the country's lack of processing infrastructure, but stakeholders at large were very positive about the future.

The future of hemp across South and Latin America looks bright, pending regulatory hurdles to iron out. "One of the things we are telling every country that wants to regulate cannabis is to please make sure you specify the difference between marijuana and hemp, and the difference between THC and CBD," says Elizalde. "Put in regulation for marijuana, put in regulation for hemp, and put in the different regulations for all of the final products." In the end, some comprehensive, well-devised regulations will help the South American market become an important part of the global hemp market.

“The future of hemp across South and Latin America looks bright, pending regulatory hurdles to iron out.”

AFRICA AND OTHER MARKETS

Africa's hemp market can be summarized in one word: Potential. Currently, the market is undeveloped, with sparse cultivation on a small base of retail sales. A significant educational process will be required among lawmakers and cultivators throughout the continent regarding the difference between hemp and marijuana, and about the range of ways in which hemp can be used to address the continent's economic growth and development challenges. Stigma against cannabis remains high in many parts of the continent, especially in traditionally religious countries, and hemp seeds are even considered poisonous in some quarters. As educational and regulatory development progresses, Africa will be positioned to capitalize on the opportunities to come with joining the global hemp industry.

For now, Africa's hemp market remains small and highly restricted. The total market sales for Africa and other markets (e.g., India, South Korea, New Zealand, and Russia, et al) was approximately $80 million in 2018. Sales in Africa and small country markets are expected to grow to $133 million by 2022, with the exceptions being India, South Korea, and Japan, which will become their own country markets as part of the broader Asian market (see New Frontier Data's *Asia-Pacific Hemp Brief: 2018 Industry Overview*). In Africa, though, retail sales did not exceed $15 million in 2018, with the majority of retail sales happening by no more than a half-dozen companies.

COUNTRY LEADERS:

South Africa:

Hemporium is located in Cape Town and has been importing and developing hemp products for more than a decade. The company collaborated in hemp trials in Western Cape that showed cultivar behavior and production capabilities. South Africa has been conducting agronomic hemp feasibility trials since 1994, and has made the most progress in developing a hemp industry in Africa. South Africa was the first African nation to legalize hemp production, but it has not issued a commercial permit. South Africa's Agricultural Research Council has tested hemp varieties of European cultivars, but all hemp products must still be imported[6].

Malawi:

Malawi first planted hemp in 2015. Invegrow, a private company, has reported successful production of hemp seed varieties and put Malawi in position to become a leader in Africa's hemp economy.

Zimbabwe:

In 2017, the government launched a program for medical cannabis and hemp production which includes research trials. Permits for commercial growing, costing $50,000, brought the government more than $7 million in application fees in the two weeks following the announcement. Three weeks later, however, the government started backpedaling, putting licenses on hold until "feasibility studies" could be performed, and to sort out a legislative framework.

In the interim, New Frontier Data has provided inputs to the Zimbabwean government about the economic impacts of deploying a domestic industrial hemp program, and the Zimbabwean government is seeing the economic benefits of deploying a cannabis regulatory program.

Zimbabwe has experienced a number of issues that have challenged economic development and participation in the international community, particularly when it comes to hemp. Limited infrastructure, lack of access to water, reluctance to convert over to a cannabis crop, chronic underutilization of farming capacity, and limited access to markets have all created barriers to the deployment of a full-fledged industrial hemp program. Look for an accelerated pace of reform policies in 2019 in Zimbabwe.

The following criteria has been developed to analyze which countries are best positioned to lead the African hemp industry: (1) The country has begun hemp cultivation and/or is selling imported hemp products. (2) The country is in "Africa's Breadbasket", where soil is optimal and crop yields can be greatly increased. (3) The country has a large GDP, with a developed agriculture industry that can support a fledgling hemp industry. (4) The country has an accredited Savory Institute Hub to support sustainable development and growth.

- **SOUTH AFRICA:**
  Pilot project started, but no licenses given; currently importing hemp products from Europe; Savory Institute Hub.
- **MALAWI:**
  Hemp cultivation commenced
- **KENYA:**
  Large GDP and agriculture industry; Savory Institute Hub
- **ZIMBABWE:**
  Developing cannabis framework; African Breadbasket country; Savory Institute Hub

- **NIGERIA:** Large GDP and agriculture industry
- **ETHIOPIA:** Large GDP and agriculture industry
- **ANGOLA:** Large GDP and agriculture industry
- **MOZAMBIQUE:** African Breadbasket country
- **TANZANIA:** Seed exports

Hemp: A Solution for Malnourishment in Africa

Hemp could play a major role in achieving the goals outlined in the African Union's "Africa 2063" and the African Development Bank's "Feed Africa" initiatives.

According to the Food and Agriculture Organization of the United Nations (FAO)'s 2017 State of Food Security and Malnutrition report, the number of chronically undernourished people in the world is estimated to have increased to 815 million, up 4.9% from 777 million in 2015, though still down 9.4% from about 900 million in 2000. The food security situation has worsened in particular parts of sub-Saharan Africa, South-Eastern Asia, and Western Asia, and deteriorations have been observed most notably in situations of conflict and conflict combined with droughts or floods.

Including hemp foods in humanitarian relief efforts – and importing to neighboring countries and in conflict zones – could have an immediate impact on malnourishment and would take advantage of the nutritional and medicinal value of hemp.

Hemp seeds are among nature's best sources for plant-based protein. Hemp protein powder is made from hemp seeds, which provide a solid nutritional boost similar to flaxseeds. Hemp has 20 amino acids, including the nine essential amino acids that your body is unable to produce on its own and must obtain from dietary sources. Hemp protein powder has dietary fiber, chlorophyll, minerals, and antioxidants without any saturated fat, cholesterol, sodium, or sugar.[7]

To address malnutrition in Africa, the African Development Bank launched its Feed Africa strategy in 2015, with a target to invest $24 billion in African agriculture over a 10-year period. The aim of the initiative is to improve agricultural policies, markets, infrastructure, and institutions to ensure that agricultural value chains are well developed, and that

> **“Hemp seeds are among nature's best sources for plant-based protein...Hemp has 20 amino acids, including the nine essential amino acids that your body is unable to produce on its own and must obtain from dietary sources.”**

improved technologies are made available to reach several million farmers.

In August 2018, the African Development Bank and the FAO agreed to boost their efforts to increase agriculture investments to end hunger and malnutrition in Africa. The two groups committed to raise up to $100 million over five years, to support joint activities.

PROPOSED NEXT STEPS: To increase adoption and accelerate education, Africa needs a unifying organization like the FAO, African Union, or African Development Bank to step forward and help countries establish a central set of regulatory standards to jump-start hemp pilot projects for research and commercial cultivation. Such action could develop regulatory frameworks and standards to start a hemp industry and protect farmers afraid that their crops might be seized by ignorant and/or corrupt government officials. The established framework should allow for the immediate importation of hemp foods – such as hemp protein powder - to malnourished countries with financial support and distribution by the parent organization, NGOs and countries receiving hemp food aid.

Additionally, we recommend that the sponsoring parent organization partner with agriculture departments at leading African universities and Savory Institute Hubs to promote sustainable management for grassland development in coordination with planting hemp pilot crops.

The FAO currently tracks hemp imports and exports. One way in which it might play a leadership role in expanding hemp opportunities on the continent would be through a coalition with the African Development Bank and African Union to import hemp seed and protein into conflicted-affected areas for humanitarian aid. The State of Food Security and Malnutrition report warns that such "situations cannot be 'business as usual' any longer, and require a conflict-sensitive approach that aligns actions for immediate humanitarian assistance, long-term development and sustaining peace."

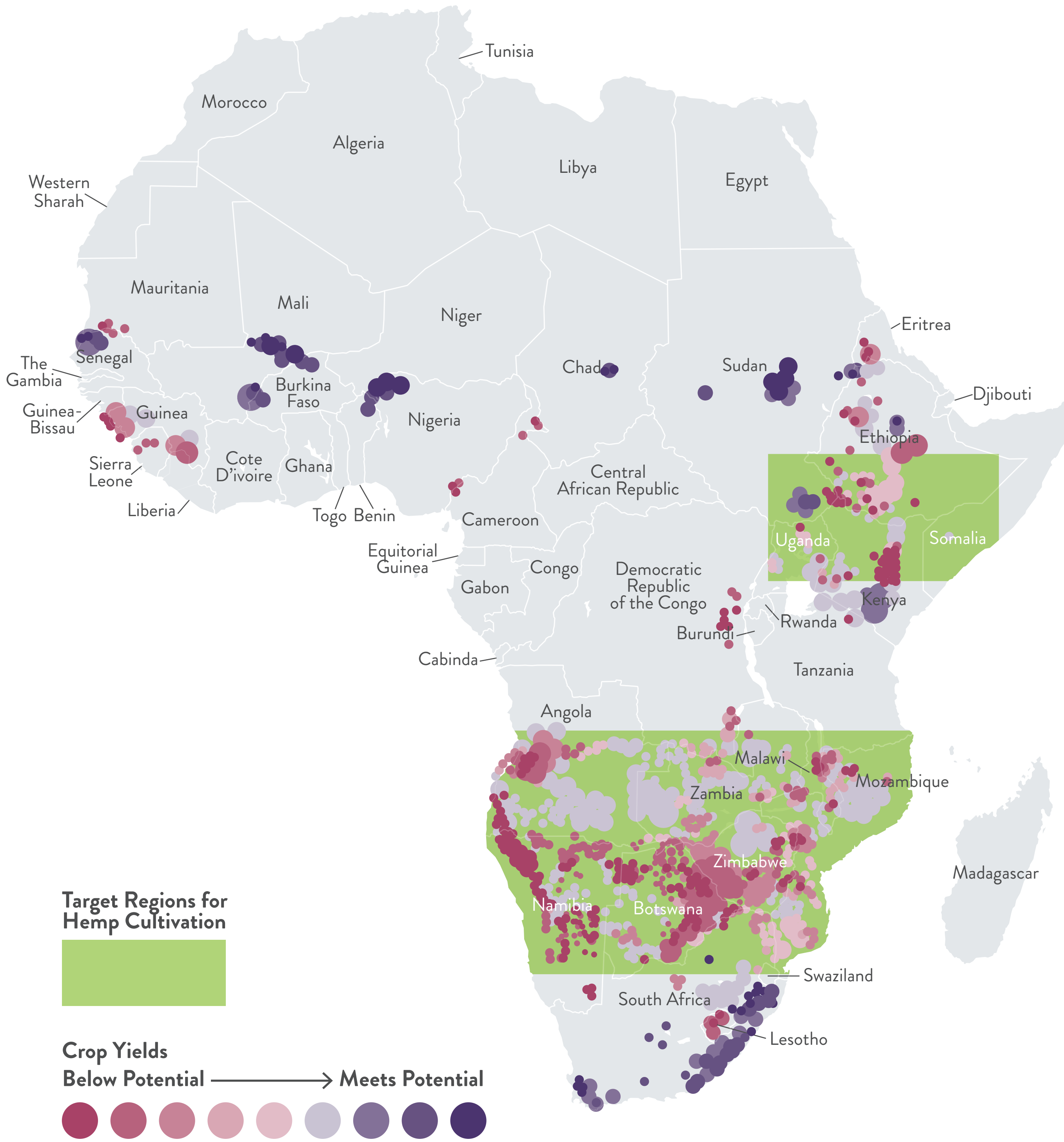
Hemp could provide immediate, innovative humanitarian solutions and long-term economic development for countries impacted by conflicts and malnutrition.

WHERE EXACTLY TO PLANT HEMP IN AFRICA

Poverty, malnutrition, civil unrest, and lack of access to credit or markets contribute to low yields on fertile ground in Africa. And yet, no region of the world is growing faster than sub-Saharan Africa, or in such need of high yield from cash crops. Today's sub-Saharan population of 926 million may hit 2.2 billion (138% growth) by 2050. In addition to the explosive population growth, the continent also faces a significant technological divide, with modernization and industrialization anchored in major population centers though a large majority of Africans still living low-tech, subsistence lifestyles.

In such context, the use of hemp in low-tech applications – whether manually produced textiles, Hempcrete-based structures to meet the continent's urgent housing needs, hempseed for human consumption, or cattle feed – can advance localized development in areas where the population has little access to capital or industrial technologies.

As Africa's economy develops, hemp can afford increasingly sophisticated applications, including



Map: Virginia W. Mason and Jason Treat, National Geographic Magazine
Sources: Joint Research Centre, European Commission; Global Landscapes Initiative, University of Minnesota; D.I. Gregory, International fertilizer Development Center; Population Reference Bureau; FAOSTAT: Hemp Cultivation Targets provided by Hemp Business Journal.

biofuels, bioplastics, and malnutrition-targeting nutritional supplements within a region where chronic malnutrition remains common.

Colors on the map show where harvests meet their potential — or fail to. Africa's gap between potential and yield represents the world's largest. Areas marked in red show where a yield gap exists in a region particularly suitable for hemp cultivation. Such regions offer the greatest potential to become hemp cultivation and economic growth centers of the future.

> "If you wrote a letter to God and asked him for the best soil and climate conditions for farming, this is what he'd send you," says Miguel Bosch, an Argentine agronomist who manages a nearly 25,000-acre corporate soybean farm in northern Mozambique. "It is a paradise for growers. I've spent many years farming in Brazil and Argentina, and have never seen such soil."
>
> JOEL K. BOURNE, THE NEXT BREADBASKET, NATIONAL GEOGRAPHIC MAGAZINE

SUMMARY:

As a true multi-crop, hemp can address systemic poverty by including small-scale producers in agronomic value chains. Hemp can provide food security by addressing malnourishment, especially in conflict zones, across the continent. And hemp can play an important role in modernizing agricultural economies and rectifying yield gaps as a cash crop that offers a spectrum of products and solutions to the continent's social and environmental challenges.

KEY TAKEAWAYS

THE 2018 FARM BILL WILL SPARK THE GREAT AMERICAN HEMP REVOLUTION

With the passage of the 2018 Farm Bill, the U.S. market is poised for rapid expansion. With the removal of hemp from the Controlled Substance Act of 1970 (CSA), banking, credit-card processing and attention from large agricultural interests will finally become accessible to hemp businesses. As FDA regulations are eased, large retailers should gain the legal protections needed to carry hemp-derived CBD products in mass-market stores and online channels like Amazon. The 2018 Farm Bill puts the U.S. hemp industry on course to compete directly with China, and spur innovation across the entire supply chain. American farmers affected by low commodity prices or Chinese tariffs on U.S. products will have opportunity for a new cash crop. The convergence of such forces should impel rapid expansion of the U.S. hemp industry.

2019: THE YEAR THAT THE THREE CBD CHANNELS SQUARE OFF

CBD is the fastest-growing sector of the global hemp industry, and will continue as a catalyst for industry expansion and maturation. The DEA's scheduling of GW Pharmaceutical's landmark CBD drug, Epidiolex, to Schedule V launched the pharmaceutical CBD sales channel. Strong sales are expected for Epidiolex to rival the revenues of marijuana-derived CBD products. Look for hemp-derived CBD, marijuana-derived CBD, and pharmaceutical CBD companies to aggressively compete for market share in 2019 and beyond as the leading sector to watch as a primary driver of the global hemp industry for years to come.

CHINA'S CBD MARKET IS POISED FOR GROWTH

Watch for the Chinese CBD market to emerge as a global force once China's laws, regulations, and market transparency improve. As education and awareness about the health benefits of CBD increase, the country will have more than 1 billion consumers to sell and market to; moreover, it will be a trade partner with India, Japan, and Southeast Asia, as its hemp industry comes online in the years to come. While the Chinese CBD market emerges, the country will continue to be the world's largest producer of hemp fiber and seeds. Its influence on global market prices for producers and processors will remain strong.

IPOs AND GROWTH CAPITAL WILL DRIVE GREATER LIQUIDITY, INVESTMENTS, AND SCALE FOR HEMP COMPANIES

As institutional investors flock toward GW Pharmaceuticals, Tilray, Aurora, and Canopy Growth, the $100 million IPO by Charlotte's Web signaled to the market at large that the hemp industry will compete (and merge) with the largest cannabis companies in the world, and is assuredly here to stay. CV Sciences, Isodiol, Medical Marijuana Inc., and Elixinol Global are

all publicly listed companies and represent a group of hemp companies with rapidly expanding market share. With better access to capital and increased funding, hemp companies are poised to begin global expansion. The question is: Who will secure global market share first between U.S. hemp companies or Canadian licensed producers? The race is on.

HIGHLY LIQUID CANADIAN LPs PURSUE GLOBAL EXPANSION

Oct. 17, 2018, marked a monumental day for cannabis — the realization of the Cannabis Act — with Canada becoming the first G-7 nation to fully legalize cannabis nationwide. The rush of liquidity into the Canadian market at the prospect of a legal national market, coupled with more favorable financial markets than the U.S., actualized Canada as home to the world's most valuable cannabis companies. Investments being made by these companies will reshape the cannabis industry as they drive efficiencies of scale, introduce innovation of new products and delivery mechanisms, and deploy sophisticated techniques to engage consumers.

The scale of the Canadian cannabis companies coupled with the country's 20 years of hemp production afford Canadian operators a considerable advantage over producers in other countries. Additionally, the liquidity of Canadian producers will enable them to acquire or invest in low-cost producers in other markets, enabling them to offset the higher costs of onshore production while securing a global supply of high-quality hemp products.

The largest Canadian LPs have been on a buying spree, acquiring hemp companies across Canada, Europe, and South America.

Watch for the M&A market to move to Europe as Canadian LPs look to secure hemp-processing, distribution, and branding deals in Europe's largest markets: Germany, the U.K, France, and Spain. As the LPs continue their global march, attention will be due Manitoba Harvest as the world's largest hemp company is well positioned to launch a CBD product line and dominate at global scale. Consider: Manitoba Harvest already has distribution arranged for its hemp products through most of the largest U.S. retailers, including Walmart, Amazon/Whole Foods, Costco, and Kroger.

AFRICA BEGINS TO TAKE STEPS TO REALIZE ITS HEMP POTENTIAL

While Africa may represent the least-developed hemp market globally, its potential cannot be overstated. The capacity for hemp's impacts and applications extends beyond the growing global market; hemp has considerable abilities to serve local economies across a range of applications. Activating a hemp industry across the continent will first require changes in public policy and social attitudes in order to decouple hemp from cannabis, and educate stakeholders about what hemp represents. Such dynamics are already underway, but will require time to fully gain traction across the culturally diverse region.

However, interest is expected to grow quickly as governments understand the diverse ways in which hemp can be used, whether to feed both people and livestock, compete against cotton and timber for textiles or paper, provide low-cost building materials, or rejuvenate over-farmed land via crop rotation, just to name a few.

Furthermore, given a collectively young and under-employed workforce, countries across the continent which produce hemp will see a significant cost advantage over more developed economies with tight labor markets. It is therefore no surprise that Canadian LPs have already begun investing in the cannabis and hemp companies in Lesotho and South Africa – the two earliest markets to liberalize their marijuana and hemp laws.

Hemp offers the makings of a savior crop for Africa, but without effective leaders to update legislation, develop regulations, and increase public education, the continent will remain a land of vast, underutilized potential.

HEMP PRODUCT INNOVATION CONTINUES

Hemp is a sustainable crop that can be cultivated to make food, fiber, and fuel. It has over 25,000 identified uses, and innovative products continue to hit the market at a rapid pace. In 2018 hemp was used in everything from semiconductors to airplanes, bioremediation to health supplements for baby boomers. Product innovation will only continue with the widening international adoption of cannabis reform. Thus, hemp presents itself as a plant for people, profit, and the planet at large.

WORKS CITED

Market data and research is cited within the report from primary data sources: SPINS, Vote Hemp, European Industrial Hemp Association, Nova Institut, FAOSTAT, U.S. Trade Online, Health Canada, Nutrition Business Journal

1. Johnson, R. (2018) "Hemp as an Agricultural Commodity," Congressional Research Service
2. Seed CX, Ltd., "Overview of U.S. Hemp Seed Imports," 2016.
3. Johnson, R. (2018) "Hemp as an Agricultural Commodity," Congressional Research Service
4. Seed CX, Ltd., "CBD Price Index," 2016.
5. Verhoef, Arne (2018, July). Savior crop for a continent? A hemp manifesto for Africa. Retrieved from: Hemptoday.net/savior-crop-for-a-continent-a-hemp-manifesto-for-africa
6. Ibid
7. Price, Annie, CHHC (2016, January). Hemp Protein Powder: The Perfect Plant-Based Protein. Retrieved from: Draxe.com/hemp-protein-powder

GLOSSARY

en.wikipedia.org/wiki/Bast_fibre
Referenced October 2018

cannabistech.com/webcasts/ask-a-hempster/what-does-hemp-biomass-actually-mean-cannabis
Referenced October 2018

en.wikipedia.org/wiki/Cannabidiol
Referenced June 2018

CSA Schedules: drugs.com/csa-schedule.html
Referenced June 2018

en.wikipedia.org/wiki/Drug_Enforcement_Administration Referenced June 2018

ods.od.nih.gov/About/DSHEA_Wording
Referenced June 2018

Dr. Sanjay Gupta: edition.cnn. com/2014/03/11/health/gupta-marijuana-entourage
Referenced June 2018

gwpharm.com/epilepsy-patients-care-givers/patients Referenced June 2018

en.wikipedia.org/wiki/United_States_farm_bill
Referenced June 2018

en.wikipedia.org/wiki/Food_and_Drug_Administration Referenced June 2018

ispe.org/initiatives/regulatory-resources/gmp/what-is-gmp Referenced June 2018

colorado.gov/pacific/agplants/industrial-hemp

leg.colorado.gov/sites/default/files/documents/2018A/bills/2018a_1187_signed.pdf
Referenced June 2018

en.wikipedia.org/wiki/Hemp_hurds
Referenced October 2018

investopedia.com/terms/i/investigational-new-drug-ind Referenced June 2018

canada.ca/en/health-canada/services/drugs-medication/cannabis/licensed-producers/authorized-licensed-producers-medical-purposes
Referenced June 2018

fda.gov/drugs/developmentapproval-process/howdrugsaredevelopedandapproved/approvalapplications/newdrugapplicationnda/default
Referenced June 2018

maximumyield.com/definition/4248/flower-cannabis Referenced October 2018.

federalregister.gov/documents/2016/12/14/2016-29941/establishment-of-a-new-drug-code-for-marihuana-extract Referenced June 2018

fda.gov/ForIndustry/UserFees/PrescriptionDrugUserFee/default Referenced June 2018

D R Laurence, A. L. Bacharach Evaluation of Drug Activities: Pharmacometrics 1483263460 2013 p.177 "PSYCHOTOXICITY"

en.wikipedia.org/wiki/Psychoactive_drug
Referenced June 2018

BAST
Bast (also called phloem fiber or skin fiber) is plant fiber collected from the phloem (the "inner bark", sometimes called "skin") or bast surrounding the stem of certain dicotyledonous plants, including hemp. Often bast fibers have higher tensile strength than other kinds, and are used in high-quality textiles (sometimes in blends with cotton or synthetic fibers), ropes, yarn, paper, composite materials and burlap.

BIOMASS
Technically speaking, lignocellulosic biomass, referring to the organic matter of a plant composed of cellulose, hemicellulose and lignin; or, the "non-food" part of the plant traditionally comprised of the stock, stem and remaining leaves, but now used as a term in the hemp industry that also may include ground up flower as part of the aggregate weigh calculation. Cellulose (fiber and pulps), Lignin (20% of the stalk) and sugars (the two primary sugars in the stalk are xylose and glucose) are three intermediate biomass materials.

CANNABIDIOL (CBD)
One of at least 113 cannabinoids identified in Cannabis sativa L ("Cannabis") which includes marijuana and hemp varieties. It is a major phytocannabinoid and does not have intoxicating effects like those caused by tetrahydrocannabinol (THC).

CBD ISOLATE
CBD in its purest form. To produce CBD isolate, hemp or marijuana is refined to stripe out any additional cannabinoids, terpenes or plant components. With CBD isolate, a patient or consumer will receive the sole benefits of CBD. In comparison, full-spectrum oil (FSO) provide the synergistic benefits (see "Entourage Effect") of the whole marijuana or hemp plant. Other cannabinoids and constituents of marijuana and hemp can be isolated including cannabinoids (e.g., cannabigerol (CBG)) and terpenes (e.g., myrcene).

CONTROLLED SUBSTANCES ACT (CSA)
Title II of the Comprehensive Drug Abuse Prevention and Control Act of 1970. It is the federal U.S. drug policy under which the manufacture, importation, possession, use and distribution of certain narcotics, stimulants, depressants, hallucinogens, anabolic steroids and other chemicals is regulated.2

DRUG ENFORCEMENT AGENCY (DEA)
The Drug Enforcement Administration is a United States federal law enforcement agency under the United States Department of Justice, tasked with combating drug smuggling and use within the United States.

DIETARY SUPPLEMENT HEALTH AND EDUCATION ACT OF 1994 (DSHEA)
U.S. federal statute which defines and regulates dietary supplements. Under the act, supplements are effectively regulated by the FDA for Good Manufacturing Practices under 21 CFR Part 111.

ENTOURAGE EFFECT
The term for a concept and proposed mechanism by which compounds present in cannabis modulate the overall effects of the plant (these resulting principally from the action of the main psychoactive component of cannabis, tetrahydrocannabinol (THC)). Cannabidiol (CBD) is believed to be the major modulatory component of cannabis, mitigating some of the negative, psychoactive effects

of THC. The term will often be used in connection with explaining the effect of a Whole Plant or Full Spectrum extract or oil.

EPIDIOLEX®

Epidiolex is GW Pharmaceutical's drug that was recently approved by the FDA. It is a proprietary oral solution of marijuana-derived CBD. Epidiolex is concentrated on severe, orphan, early-onset, treatment- resistant epilepsy syndromes.

FULL-SPECTRUM CBD OIL (FSO)

Wholesale CBD product sometimes referred to as "whole-plant extract." FSO contains a variety of essential vitamins, minerals, fatty acids, protein, chlorophyll, terpenes, flavonoids and fiber. Hemp and marijuana plants may contain a large number of cannabinoids (in trace amounts) but the main compounds present are CBD and cannabidiolic acid (CBDa). FSO is used to make a variety of consumer products.

FARM BILL (2018)

The Farm Bill is the primary agricultural and food policy tool of the U.S. federal government. The comprehensive omnibus bill is renewed every 5 years (approximately) and deals with both agriculture and all other affairs under the purview of the United States Department of Agriculture (USGA).

FOOD AND DRUG ADMINISTRATION (FDA)

A federal agency of the United States Department of Health and Human Services, one of the United States federal executive departments. The FDA is responsible for protecting and promoting public health through the control and supervision of food safety, tobacco products, dietary supplements, prescription and over-the-counter pharmaceutical drugs (medications), vaccines, biopharmaceuticals, blood transfusions, medical devices, electromagnetic radiation emitting devices (ERED), cosmetics, animal foods & feed and veterinary products.

FLOWER

Flower, or "bud" refers to the part of the hemp plant that appears as either male flowers, which are large, bell-shaped clusters, or female flowers, which are tear-shaped with pistils. The female flowers tend to be large and secrete ample cannabinoid and terpene-laced resin to attract pollinating insects. The male flowers of the cannabis plant produce very little cannabinoids and are not normally considered of value. When a female flower is denied male pollen, it continues to produce more and more cannabinoid and terpene-rich resin to attract insects for possible pollination. The abundant resin is why unpollinated female buds are the most coveted part of the cannabis plant.

FOOD, DRUG, MASS & CLUB (FDMC)

Sales channel that includes Walmart, Target, Kroger, Walgreens, CVS, Costco, and more.

GOOD MANUFACTURING PRACTICES (GMP)

GMP refers to the Good Manufacturing Practice Regulations promulgated by the US Food and Drug Administration under the authority of the Federal Food, Drug, and Cosmetic Act. These regulations, which have the force of law, require that manufacturers, processors, and packagers of drugs, medical devices, some food, and blood take proactive steps to ensure that their products are safe, pure, and effective. GMP regulations require a quality approach to manufacturing, enabling companies to minimize or eliminate instances of contamination and errors. This in turn, protects the consumer from purchasing a

product which is not effective or even dangerous. Failure of firms to comply with GMP regulations can result in very serious consequences including recall, seizure, fines, and, in extreme cases, jail time.

HEMP

Section 7606 of the 2014 U.S. Farm Bill defines industrial hemp as “the plant Cannabis sativa L. and any part of such plant, whether growing or not, with a delta-9 tetrahydrocannabinol concentration of not more than 0.3 percent on a dry weight basis.”

HEMP-DERIVED CBD

CBD derived from the hemp plant, whereby hemp is a plant of the genus Cannabis and any part of the plant, whether growing or not, containing a delta-9 tetrahydrocannabinol (THC) concentration of no more than three- tenths of one percent (0.3%) on a dry weight basis. In the United States, industrial hemp cultivation must be done in accordance of Sec. 7606 of the 2014 Farm Bill.

HOUSE BILL 18-1187

A Colorado bill concerning the lawful use of a prescription drug (i.e. Epidiolex) that contains CBD that is approved by the United States food and drug administration. The Bill, that was signed by Governor John Hickenlooper on June, 4, 2018, included language to protect marijuana and hemp companies, saying specifically, “the general assembly does not intend for this legislation to be construed so as to prohibit, preclude, or otherwise affect previously authorized activities concerning products derived from marijuana, industrial hemp, or other lawful sources which contain cannabinoids but which are not a prescription medicine approved by the United States Food and Drug Administration.”

HURD

Hurd is an agricultural product made from hemp. Hurds consist of the woody inner portion of the hemp stalk, broken into pieces and separated from the fiber in the processes of breaking and “scutching" and "correspond to the shives in flax, but are coarser and usually softer in texture" Hurd is traditionally a by-product of fiber production.

INDUSTRIAL HEMP

In our reporting “hemp” and “industrial hemp” are used interchangeably. See “HEMP” above.

INVESTIGATIONAL NEW DRUG (IND)

An application that is the first step in the drug review process by the U.S. Food and Drug Administration (FDA). The application is submitted by the company responsible for developing the drug (the sponsor) to the FDA.

LICENSED PRODUCERS (LPS)

Companies issued a license by Health Canada under the Access to Cannabis for Medical Purposes Regulations (ACMPR). Only producers who are authorized to produce and sell to the public may sell or provide dried marijuana, fresh marijuana, cannabis oil, or starting materials to eligible persons.

MARIJUANA-DERIVED CBD

For the purposes of this report, the term marijuana is used (not “cannabis”) since marijuana is still the legal term that explains how and where Cannabis sativa L is licensed, cultivated and sold through the Dispensary Channel. To call it cannabis-derived CBD, is to conflate legal terminology given marijuana and hemp are both technically Cannabis sativa L. As such, marijuana-derived CBD is Cannabis sativa L grown under a state marijuana

license and sold through a licensed dispensary (medical or adult-use) where the plant usually contains delta-9 tetrahydrocannabinol (THC), but not always, as is the case with "No THC" plants grown under a marijuana license (not a hemp license) but sold through a dispensary. The licensing and legal terminology drive our definitions. As laws change and public education increases, HBJ may change marijuana-derived CBD to cannabis-derived CBD.

NATURAL PRODUCTS INDUSTRY (NPI)

The name for the $100+ billion U.S. industry spanning the manufacturing, distribution and sales of natural and organic products, including food, supplements and ingredients.

NEW DRUG APPLICATION (NDA)

The vehicle through which drug sponsors formally propose that the U.S. FDA approve a new pharmaceutical for sale and marketing in the U.S.

NEW DRUG CODE 7350

The newly created DEA Administration Controlled Substances Code Number for "Marihuana Extract." According to the DEA, extracts of marijuana will continue to be treated as Schedule I controlled substances.

PRESCRIPTION DRUG USER FEE ACT (PDUFA)

Law that created a program that authorizes the FDA to collect fees from companies that produce certain human drug and biological products. Since the passage of PDUFA, user fees have played an important role in expediting the drug approval process. As of 2017, 3/4th of the FDA budget (approximately $700 million) is funded by pharmaceutical companies due to the Prescription Drug User Fee Act.

PSYCHOTOXIC VS. PSYCHOACTIVE

In pharmacology, psychotoxic is the effect when a drug interferes seriously with normal behavior. In pharmacology, a psychoactive drug, psychopharmaceutical, or psychotropic is a chemical substance that changes brain function and results in alterations in perception, mood, consciousness, cognition, or behavior.

PHARMACEUTICAL CBD

The industry category to describe drugs containing CBD. Although a pharmaceutical may be plant-based and derived from cannabis, if it is a drug, then HBJ classifies it as Pharmaceutical CBD which implies a drug pipeline consisting of clinical trials, IND, NDA, PDUFA and FDA approval before going to market. This process is very different across legal, research, distribution, sales and economic factors.

PRACTITIONER CHANNEL

The Natural Products Industry sales channel to describe healthcare practitioners which includes Medical Doctors (MDs), Doctors of Osteopathic Medicine (DOs), Naturopathic Doctors (NDs), Doctors of Chiropractic (DCs) and Doctors of Veterinary Medicine (DVMs).

THC-FREE CBD DISTILLATE

Wholesale CBD product sometimes referred to in the hemp industry as "the honey" for its honey-like appearance and color. THC-free CBD distillate is created by using SMB chromatography to refine already extracted hemp and marijuana material (concentrate oil)—by separating and concentrating three distinct fractions: cannabinoids,

the lighter volatiles (terpenoids and flavonoids) and the non- volatiles—the heavier, unwanted materials (pesticides). THC-free CBD distillate is the most concentrated and purified form of CBD oil, and as such commands a higher wholesale price than CBD FSO or CBD isolate.

WHOLESALE PRICING DISCLAIMER

The U.S. hemp industry is a nascent and immature agricultural market. The wholesale market section of is one of the first attempts to define and analyze wholesale products and pricing in the U.S. hemp industry. There exists a wide range of prices that often fluctuate based on market demands and product availability. Given this, HBJ has limited the scope of analysis due to sparse data and the complex and often highly confidential transactions between buyer and seller. There are still considerable market inefficiencies and no established standards for cultivation, spot pricing, future contracts, brokering and processing within the industry. These dynamics lead to inefficiency and opacity in the market, resulting in a wide range for prices . The following section lays the foundation for pricing estimates in this highly variable market. Hemp Business Journal will continue to update the pricing models as more data becomes available and as the market stabilizes.

NewFrontier® data

HEADQUARTERS
1400 I Street NW / Suite 350 / Washington, DC 20005

SALES & MARKETING
535 16th Street / Suite 620 / Denver, CO 80202

info@newfrontierdata.com 844-420-D8TA

@NewFrontierData

Strength in Knowledge™

NEWFRONTIERDATA.COM

INTERCANNALLIANCE.COM

COPYRIGHT